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ABSTRACT

This document consists of all five issues of the journal "Instructional Developments" published during the period 1990-1992. This journal is intended for the communication of opinions, ideas, findings, and achievements in the improvement of instruction. The five issues presented in this packet contain the following articles: "Viewpoints on Instruction" (four brief papers by Tom Green, Saviour Chircop, Alex Romiszowski, Phil Doughty); "Is There a Scientific Basis for Effective Teaching" (John Centra); "The Diffusion and Implementation of Educational Technology in Developing Nations" (Don Ely); "Programmatic Research and Development at Syracuse University" (Charles Dills); "Computer Mediated Communication--An Overview" (five papers by Karen Jost, Tom Green, Barbara Florini, Barbara Grabowski, Alex Romiszowski); "Some Thoughts on Improving Instruction" (Rob Branch); "Course-Level Academic Processes as Indicators of the Quality of Undergraduate College Education" (John Braxton); "Structural Communication" (Wende Pusch, Elisa Slee); "Interpersonal Skills: Critical Attributes for Instructional Developers" (Ruth Curtis, Darlene Nestor); "Planning for Success: College Distance Education Programs" (Lynda Hanrahan); "Moving from Pedagogy to Andragogy" (Roger Hiemstra); "The Case-Study Methodology and Instructional Development" (Alex Romiszowski, Martin Mulder, Jules Pieters); "Background and Experiences of New Faculty" (Mardy Eimers); "Computer-Based Interactive Video: The Potential for Effective Instructional Environments" (Karen Jost); "Establishing an Instructional and Faculty Development Effort at SUNY-ESF" (Charles Spuches); "The Syracuse University Focus on Teaching Project" (Robert Diamond, Peter Gray, Alton Roberts); "What Is the Role of Educational Technology in Generating Change in Public School Education?" (Richard Kenny); "Establishing a Self-Instructional Development Facility at NAARM" (Aradhyula Gopalam, K. V. Raman); "Formative and Summative Evaluation Procedures for Interactive Video in the Nuclear Industry" (Barbara Grabowski, Elisa Slee); "Automated Job Aides for Instructional Design and Development" (Michael Olson); "Research as a Chain of Reasoning" (David R. Krathwohl); "Affective Objectives: A Discussion of Some Controversies" (Cheryl Ackerson); "The Writings of David Krathwohl" (Charles Dills); "Methods of Social Science and Educational Research" (Charles Dills, Vincent Tinto); "Review of David R. Krathwohl, 'How To Prepare a Research Proposal: Guidelines for Funding and Dissertations in the Social and Behavioral Sciences,' Third Edition" (Deborah Fournier, Nick Smith); "Research in Hypertext" (Lydia Doty). A section entitled "Job Aids," by Alex Romiszowski, which deals with problems, concepts, and issues raised in earlier articles, appears in each issue of the journal. (ALF)

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Instructional Developments

A Journal of the School of Education at Syracuse University
Spring 1990 Volume 1, Number 1

Feature Articles

Viewpoints on Instruction — *Tom Green, Saviour Chircop, Alex Romiszowski, Phil Doughty*

Is There a Scientific Basis for Effective Teaching — *John Centra*

Research Reviews

The Diffusion and Implementation of Educational Technology in Developing Nations: Cross-Cultural Comparisons on Indonesia, Chile and Peru — *Don Ely*

Programmatic Research and Development at Syracuse University: The IDD&E Working Paper Series — *Charles Dills*

Developments and Innovations

Computer Mediated Communication — *Karen Jost, Tom Green, Barbara Florini, Barbara Grabowski, Alex Romiszowski*

Job-Aids — *Alex Romiszowski*

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Instructional Developments

Volume 1 *Number 1*

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This is the first edition of INSTRUCTIONAL DEVELOPMENTS. Our reasons for launching it are many. Not least among them is to provide a vehicle for those who are concerned with the improvement of instruction to communicate their opinions, ideas, findings and achievements to others who may be able to make use of them.

The stress is on practical value. We shall make efforts to synthesize and generalize the trends of research, putting them into an easy-to-use form to act as reference material. We shall support these syntheses with annotated bibliographies, referring the reader to original sources and full length accounts. Feature articles will present a technique, or a point of view, that may be of practical value to teachers, instructors, training developers, or the managers of instructional innovation projects. Finally, the job-aids section will be a regular feature, that will present information on specific practical topics in a ready-reference format that may be of permanent value to the education or training professional.

The *feature articles* section, in this issue, deals with the concept of instruction, attempting to establish its meaning and its theoretical bases. First, we have four "viewpoints" on instruction and its design. These viewpoints on the concept of instruction are followed by John Centra's viewpoint on the scientific basis for instruction. To what extent does teaching have a scientific basis and to what extent is it an art, or a craft? We would like to hear your viewpoints.

The *research review* section includes Don Ely's report on comparative research on the adoption of Educational Technology in three countries. This is a good example of the breadth of work and of interests that we plan to represent. We hope to include some international contributions in every issue. Charles Dills' review of programmatic research on instructional design carried out by the IDD&E program's faculty and students over the last decade is a short report on what has been done and a guide to a series of detailed reports on the studies. Without a doubt, the work reported is only one strand of the last decade's research on instructional design theory. It is, however, quite a well developed and influential strand, that some readers may be particularly interested in following . For this reason, we have listed all the available working papers, which may be obtained.

The *developments and innovations* section deals with an increasingly important aspect of distance education—the growing use of interactive conversational methodologies, based on the many recent innovations in teleconferencing. We discuss computer-mediated communication (CMC) in its various forms: electronic mail, hypertext, computer-conferencing, and so on. All the applications described are at Syracuse University and are currently ongoing. There are, of course, many other possible applications of CMC. Readers may like to comment on the cases described or add examples of their own.

We also include a *job-aids* section dealing with the topic of job aids itself. We have built in a few problems and challenges to generate some discussion of this section.

Finally, we have included a number of short, informative items on activities and services that may be of interest to educational and training professionals.

We hope this journal will create a dialogue between ourselves and you, the readers. Most authors are prepared to furnish further details of their work, reprints of their papers and are interested to hear your reactions and comments. To facilitate your requests for further information, there is a response coupon for you to complete and return on the last page of the journal. This response slip also requests your general evaluation of the journal's contents. If you have any more detailed comments on specific items, please enclose them as well, in a separate letter. We will transmit it to the author(s) concerned.

-- Alex Romiszowski

Viewpoints on instruction

What is instruction? What are the commonly used meanings of the term? Is it just a widely, and loosely, used word that has lost value as a technical term of the teaching profession? What about instructional design? Is this a prescriptive, procedural activity that pre-defines the steps of a planned teaching/learning activity, or is it an "online" heuristic process, carried out by the teacher in the light of events that occur during interaction with students? In April of 1989, the students of the Instructional Design, Development and Evaluation program organized a round table forum on the meanings of instruction and its design. As an opener to this first issue of our journal, the participants of that discussion have summarized their viewpoints, as presented on that day and as they have matured in the intervening year.

Firstly, we have Tom Green, Professor of Cultural Foundations, presenting an analysis of the term instruction and its common usage. Next, Saviour Chircop, doctoral candidate in the IDD&E program and research assistant in the Office of Professional Development, argues that the emphasis in the practice of instructional design is too much on the prescriptive preplanning of events and activities according to some generic model.

He is followed by Alex Romiszowski, Professor of IDD&E, who presents a definition of instruction couched in technical "systems theory" terms and argues that this concept is valid and useful whatever philosophical or theoretical bases are adopted for the process of instructional design.

Last, Phil Doughty, also Professor of IDD&E and currently interim Dean of the School of Education, takes the "macro" view of instruction as an activity to be designed, developed and delivered not only effectively and efficiently, but also cost-effectively. Like any other activity that consumes resources and is supposed to generate worthwhile returns, the instructional process must be managed.

Thinking about instruction: Shades of usage

Tom Green

Here are some ways of thinking about "instruction."

"I was instructed to take my application to the next window." Here, "instructed to..." is always followed by an infinitive. It is equivalent to "told to..." or "I was ordered (directed) to...". This is not transmission of belief, or knowledge, or even information.

"When I was twelve, I took instruction in The Faith." Here, "took instruction" (as well as "gave instruction") involves having certain beliefs explained to me (or explaining them to someone else depending on whether instruction is being taken or given.) Here the focus of "instruction" is on the acquisition or elaboration of belief.

"I had twelve years of piano instruction and still can't play" Here "instruction" is dispensable. One might say simply "I had lessons" or "took piano," or "studied piano" and the term "instruction" needn't even appear. In fact, the use of "instruction" at all in such a context may seem awkward.

But there is something noteworthy about this usage. It seems not to occur at all unless there exists something like standards of performance. This is clearly a context of acts and not beliefs. But we don't ordinarily think of taking instruction in walking, for example. If someone were to suggest doing so, it would imply immediately that there is some special skill being developed. Perhaps we are speaking of a class in acting or in modeling. What would come to mind if someone told you that she was taking instruction in breathing? Here, in short, is a sense in which "instruction" probably involves communication of belief or information, but more importantly involves the acquisition of skill and standards of judging some kind of performance.

There may be a hint here. We speak of "instructing in..." "instructing to..."or "instructing how to..." but not "instructing that..." unless it is equivalent once again to simply being told. For example, to pursue a previous illustration, "I was instructed that God is three in one" or "I was instructed that the doctor is not in." This is the same as "I was told that." These examples illustrate how "instructed that..." is used in a manner that matches "told that...".

We may summarize:

"Instructing to..."
Call this the imperative mode of "instruction." It involves giving orders. The aim is not conveying information, knowledge, belief or skill. And we wouldn't normally think of this kind of "instruction" as aimed at learning.

"Instructing that...
Call this the propositional mode of instruction. Whatever follows the "that..." can be expressed as a proposition. "Instructing" in this sense is simply the same as telling. "A instructed B that..." simply means "A told B that...".

Viewpoints on instruction

The propositional mode of instruction is clearly aimed at transmitting belief, information, or knowledge, and there is a sense of "learning" in which "I just learned that..." means "I was just told that...".

"Give (take) instruction in..."
Call this the global sense of "instruction" because we seem to use the term in this way only when speaking of instruction in relation to some larger subject or, more likely, some practice that implies the presence of standards. We speak of one person instructing another in specific skills (like breathing) only within the context of some larger practice (swimming, singing, acting) and it is because of this global placement that the term "instruction" has its use in education. These comments seem to apply also to "instructing how to...". I do not see that this locution, "instructing how to...," contributes any fresh logical point to the analysis.

Think of the kinds of things (beings) to which we can offer instruction. We don't instruct plants. Nor do we teach them or educate them. But we do train them. Here is context where the concept of "training" seems to have a play, but "instructing" does not. What about animals, say, my Golden Retriever (whose dignity suitably demands caps)? Unlike the case of plants, it makes sense to say that I can educate the dog, or that I can teach him. But what about giving him instruction?

I do not say that there is any rigorous, final, firm boundary to be drawn here. But we are not seeking firm boundaries. We are seeking only to discern what counts in shaping the domain of one concept as opposed to another — "instructing" in contrast to, say, "teaching" and "educating." Here is a context in which "educating" and "training" seem to have a play, but "instructing" and "giving instruction" do not. It is easier to speak of "training my dog to fetch," "teaching him to fetch," but more awkward to speak of "giving him instruction."

If you grant me that there are these shades of usage, these tendencies of thought, then I want to ask where they come from. What it is that underlies these gradations of meaning?

I submit that the answer lies in the degree to which our aim is to enlarge the domain of intelligence. To whatever degree we aim at creating an intelligent way of believing or an intelligent way of behaving or acting, in just that degree, it becomes easier to speak of "instructing" and more difficult to speak of "training" or "conditioning." We speak of training a plant, but not of instructing it or even of teaching it simply because we do not think of the plant's pattern of growth as manifesting intelligence. We speak of training, or even teaching a dog to fetch or to heel, but not of offering instruction because we conceive of the animals behavior as more expressive of intelligence than that of the plant. But still, there is something missing.

The missing part is what I would call "the conversation of instruction." The dog does not ask "Why?" or "Why not?", does not seek reasons, and does not receive explanations. The concept of "instruction" is most at home in its global sense, when it involves the "conversation of instruction," the search for reasons. The central idea, in short, is not simply that a certain behavior be produced, or a certain belief be entertained, but that behavior be shaped and belief formed for reasons shared by instructor and student in the context of a conversation. It is the presence or absence of this kind of intelligence in greater or lesser degree that accounts for the shades of meaning between "instructing," "training," indoctrinating," "teaching" and the like. The core idea is the effort to shape behavior and belief in ways that manifest the presence of intelligence.

CID GOES TO SINGAPORE

Robert M. Diamond, Assistant Vice Chancellor, Director of the Center for Instructional Development (CID), and Professor of Instructional Design, Development, and Evaluation was in Singapore for two weeks in November serving as a consultant to the National University of Singapore and the National Institute of Education. During this period he was keynote speaker and workshop leader at an all-university seminar for faculty. His topics ranged from designing and improving courses and curricula and evaluation for tenure and promotion to the selection and use of technology. While there, he also met with university administrators and faculty in discipline-specific meetings to discuss with them Syracuse University's Center for Instructional Development, the approach it uses and the impact the agency has had on the institution. A project, sponsored in part by the Sears-Roebuck Foundation on increasing the importance of teaching and the tenure and promotion process, was also a major topic of discussion.
CID is one of the strongest university-based educational development service centers in the country. It helps university faculty members design, implement, and evaluate their courses and programs, as well as providing consulting services for clients on a national and international basis. Components of CID include instructional development, research and evaluation, graphics and printing.
Further information on the CID, its activities and services may be obtained by completing and returning the coupon on the last page of the journal.

Viewpoints on instruction

Instructional Design: Where we were . . . Where might we go

Saviour Chircop

There are various ways of framing the work done by instructional designers. A cursory look at the emergence of the field is enough to indicate a rapid and flexible development that has primarily been driven by the pragmatic concerns -military, industrial, and to a small extent scholastic- of the last five decades.

Instructional design and development, as we know it today, was initiated by professionals who believed in the use of visual aids to support oral instruction. The advocacy of media centers, to support the visual aids movement, led to the development of learning centers where students could use individualized instruction to supplement their regular academic classroom experiences. In the sixties, under the influence of Skinner, the field shifted from a reliance on technology-supported communication, to a mixture of technology (both hardware and engineering frameworks), communication theory and theories of learning. With Robert Gagne, instructional sciences moved from the Skinnerian influence to a more cognitive model of learning influenced by, among others, Jerome Brunner.

A global perspective of this development can be framed as "a field whose theory and practice primarily deal with structured communication for the purpose of learning". Instructional theory attempts to uncover an effective and efficient way to structure its messages. This approach explicates that the communication assumptions in the field, though elaborate and far reaching, are largely based on the work of Hovland and others, implicit in presentations, texts, and CBT.

Current research in the areas of communication and semiotics, especially work by Brenda Dervin, is showing that the Hovland paradigm of communication and persuasion theory needs to be updated. The theoretical construct, assumed by Lasswell, Hovland and others, places excessive emphasis on the "power" role of the "sender" and too little on the active role of the "receiver". The very choice of terms "sender" and "receiver" is evidence to this. Instructional theory has substituted the term "receiver" with "learner" and created illusory images of learners who are objects; passive recipients of the instructional processes created for them. This approach to the process of instruction is clearly teacher-driven. However, this is not an accurate description of situations that face designers. Instructional designers need to acknowledge and account for the intentionally, free will, socio-political environment and previous experiences of the learning subject in present theoretical perspectives.

The implications of this shift for instructional theory and design are pivotal. Work and research, reflecting such a shift are already appearing in the fields of adult education, cognitive psychology, and instructional design itself. Malcolm Knowles and Patricia K. Cross argue for a pedagogy addressing adults that has some different attributes from a pedagogy aimed at reaching children. Followers of Jean Piaget argue for respecting the internal dynamism of the learner who is constantly interacting with an environment. The learner is in the driver's seat of the change process. Robert Gagne in a recent article talked about the incompleteness of the present instructional theory. He suggested that designers need to incorporate more, and account for, the incidental learning that occurs in the every-day-life as part and parcel of what goes on in every instructional event. Lauren Resnick suggests that instructional designers need to re-examine their learning theory which separated facts, principles, procedures and concepts as if they were discrete entities.

This shift of emphasis also affects the type of analysis designers perform to determine task analyses, the learner entry point and learner pre-requisites. In many instances of current practice such analytical activities are being driven by the content of instruction (subject matter). Henceforth, instructional designers need to explore ways of understanding better the human persons who are asking for instruction. Instructional methodology has to adapt itself to persons as human subjects -as different from human objects- and not the other way round.

Viewpoints on instruction

Instruction and Learning: What's in a Name?

Alex Romiszowski

I was brought up in Britain. I learned early in my life that "teachers" are found in schoolrooms, whereas "instructors" inhabit dirty workshops, military establishments and sports or athletics fields. Somehow, the figure of "teacher" was linked conceptually to "education", whereas the "instructor" was a component of "training systems". My first professional contact with "instruction" as a precise technical term, was in the 1960's when "programmed instruction" was at the height of its popularity - except that in Britain it was immediately rechristened as "programmed learning".

These semantic preferences run deep. We notice it in the preferred use of CAL (computer assisted learning) and CAMOL (computer assisted management of learning), as opposed to the US preferred terminology of CAI and CMI (I for Instruction). British researchers, for example the cybernitician Gordon Pask, have contrasted the so called "instructional" and "conversational" paradigms of education and have developed quite sophisticated "conversational theories" to guide their design of educational materials. In contrast, Tom Green argues in this paper that instruction includes an essential conversational element.

More recently, in the educational technology literature, one comes across contrasts being made between "instruction" and "construction", as rival educational paradigms. Charles Reigeluth (1989) discusses these contrasting viewpoints in his paper in the first issue of the new "Educational Technology Research and Development" (ETR&D) journal (previously ECTJ). He argues that both the "instruction" and the "construction" approaches are valid and indeed necessary for effective education, but that each has its defined role and place. He also indicates where he picked up the idea of this distinction - from none else than the "Brits" at a conference hosted by the U.K.'s Open University. What he does not clarify sufficiently, is that the contrast between "instruction" and "construction" as recently defined, is only a new way of reviving the dichotomy between "expository teaching" and "discovery learning", a discussion that goes way back to Ausubel versus Bruner and beyond. To be sure, the implementation TACTICS may have changed somewhat (e.g. through the use of computer based interactive media) but the basic STRATEGIES implied by the instruction-versus-construction debate are as old as the hills.

In the previous paragraph, I used the words expository TEACHING and discovery LEARNING advisedly. Once more, we see a contrast of emphasis between what is done TO THE LEARNER by some external person or system, and what the LEARNER DOES, or as Saviour Chircop puts it elsewhere in this paper, between the roles of the "sender" and the "receiver" in communication. Saviour is not alone in his view that in the past the emphasis has been too much on the "sender" and not enough on the "receiver". William Winn (1989) has argued this point quite recently. Also, somewhat earlier, Michael Eraut, in the opening keynote presentation at the 1987 Conference of the Association for Educational and Training Technology, of the U.K., presented a very detailed analysis of past and present practice, which identified some seven specific weaknesses in past approaches. He also mentions some seven strengths - provided they are interpreted and applied in practice in the light of new research completed in the last 20 years (Eraut 1988). Finally, he showed, by examples, that the turn-around in emphasis can occur, and indeed often has occurred, in recent projects. So let's not be too despondent. (Incidentally, it is worth observing that Eraut's address was entitled "What has happened to LEARNING DESIGN?" - there go the Brit's again!).

So, what about "instruction"? Is it a misunderstood word? Or should it be relegated (as in Britain) to just one form of teaching-learning process, where the emphasis is on "sending" packaged messages? My own definition of the term has for decades been "a GOAL-DIRECTED, TEACHING/LEARNING PROCESS, which has been to some extent PRE-PLANNED AND PRE-TESTED". This definition excludes educational activities which happen haphazardly without a clear idea of what learning is to be achieved, or without some attempt at design and evaluation. On the other hand, it includes a lot . It says nothing about who sets the goals (instructor or learner, sender or receiver). It says nothing about how the goals are to be achieved (exposition or discovery; instruction, construction , or indeed conversation). It does imply, however, that the methods are well matched to the goals and lead to successful learning. This is the task of instructional (or

learning?) design.

If we indeed have a scientific basis for teaching (as John Centra argues elsewhere in this issue), then teachers CAN be technologists (which means nothing else than applied scientists). If there is still a skewed emphasis in favor of the "teacher teaching" rather than the "learner learning," is this because our scientific basis is incomplete and skewed , or is it because we (meaning teachers, educational institutions, society as a whole) CHOOSE to apply certain principles toward the achievement of certain goals and ignore other alternative approaches. Should we interpret the reasons for the apparent skew in emphasis as lack of research-based principles to guide our instructional design decisions, or as lack of interest/motives/support to change the direction of things? If you vote for the latter (as I do), then you will look elsewhere than instructional theory for the root causes of our apparently distorted approaches to instruction and to instructional design.

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Instruction and Goals for Educators

Phil Doughty

It is evident these days that creating efficient instruction, planning for effective learning, or developing time saving protocols for the design of training are appropriate but insufficient goals for professionals in the education business. Pressures to expand the range of educational services to include all pre-schoolers, those with functional and workplace literacy deficiencies, professionals requiring continuous upgrading of skills and knowledge, and athletes with inadequate basic skills represent some of the challenges facing educators. How to think about planning for instruction, organizing for learning and managing training (or other combinations thereof) is one of the more complex areas of opportunity available for us to consider. Several comments about this opportunity, particularly as it relates to instruction, may not clear up the confusion but may help clarify the task.

In the very recent past, perhaps last semester, it was acceptable to discuss the three most basic criteria employed in designing and evaluating instruction as if there were choices between them. The criteria, a) good, b) fast and c) cheap, suggested options for combining any two at the expense of the third. Thus you could aim for quick and effective instruction but it would be expensive either to develop or to implement. If a limited budget was a constraint, then either the quality or the amount of time required to design, to learn, to practice, to test, or to justify was constrained. This way of thinking about instruction, learning, design and the validation thereof is not very satisfying and, more importantly, will it ever allow us to completely address the many time, cost and quality pressures facing societies, agencies, governments and day care centers.

It is evident that we must approach instruction and all its attendant components, with the intention of creating, developing, managing, empowering and validating instruction; that is:

a) good (i.e., it has relevance, utility and quality)
b) fast (i.e., it is efficient in both design and delivery as well as requiring relatively limited time-on-task by learners) and
c) cheap (i.e., expensive designers, content specialists, delivery systems, trainee travel, faculty and time away from work are all minimized).

How we think about instruction, the ways that learning might occur and the purpose of the education enterprise are all critical issues for education professionals to consider. The good, fast, and cheap requirements certainly do not make our task any easier but unless we can include all three, we will continue to address appropriate but insufficient goals.

Is There a Scientific Basis for Effective Teaching?*

*John A. Centra***

In his well known book, The Art of Teaching, Gilbert Highet (1959) argues that teaching is an art, not a science. Teaching, he proposes, involves emotions which cannot be systematically appraised and employed; moreover, a scientific relationship between humans, whether it be in teaching, marriage or friendship will be inadequate and as "cold as a chess problem." To Highet, teaching is more like painting a picture or composing music.

Is teaching an art? Does good teaching require the creative skill that good art requires? Are people born with the appropriate skills needed to be a good teacher—skills that may be somewhat personal and uncovered only through practice? If so, then it is unlikely that we can do very much to develop teachers or to systematically assess performance in teaching. Whether teaching is solely an art, and whether good teaching can be prescribed are not trivial questions. They in fact form the cornerstone for evaluating and improving what teachers do.

In this paper I propose that the knowledge acquired about college teaching through careful observations and studies over the years has provided a scientific basis for the art (or perhaps the craft) of teaching. Studies have identified prescribed attributes related to good teaching. This is not to say that no room is left for variations on principles or for individual expression. Teachers are not computers. Creativity, individuality and other human qualities are important features that are integral components of good teaching. Gage (1979) sees teaching as a practical art that calls for "intuition, creativity, improvisation, and expressiveness"; as such it leaves room for "departure from rules, formulas, and algorithms" (p. 15). I will return to this point later.

Qualities of good teaching

Although he proclaimed teaching to be an art, Highet went on to describe the qualities and abilities necessary for good teaching. The qualities he included were knowledge of subject, a sense of humor, and an enjoyment of students. Highet even specified critical methods of good teaching; for example, preparing course and class outlines or other ways of providing structure for a course. Many of these abilities and methods appear to be subject to observation and evaluation, and to be teachable in themselves. As such they may be less art-like than Highet claims.

Other characteristics of good teaching are similarly open to evaluation and study. A syntheses of 31 studies in which students and faculty members specified those characteristics important to good teaching revealed extensive similarities across studies as well as between the two groups (Feldman, 1988).

In these studies, students and faculty members at the same institutions (two-year as well as four-year colleges) were asked to describe attitudes or practices important to good teaching; some students asked respondents to characterize "best" or "ideal" teachers. Students and faculty members gave high rankings to:

- Teacher's Sensitivity To and Concern With Class Level and Progress;
- Teacher's Preparation/Organization of the Course;
- Teacher's Knowledge of the Subject;
- Teacher's Enthusiasm (for Subject or for Teaching);
- Clarity and Understandableness;
- Teacher's Availability and Helpfulness;
- Instructor's Fairness;
- Impartiality of Evaluation of Students, and
- Quality of Examinations.

Students, in these studies, placed somewhat more emphasis than faculty on teachers' stimulation of interest and their elocutionary skills.

Faculty gave more importance than students to teachers being intellectually challenging, encouraging independent thought and motivating students to do their best. Both groups also mentioned the teacher's concern and respect for students, the nature and value of course material, the quality and frequency of feedback to students, and the teacher's openness to opinions of others along with their encouragement of questions/discussion.

All in all, the studies synthesized by Feldman indicate that faculty and students were very similar in their views of what constitutes good teaching, although differences in the relative importance of a few characteristics were also evident.

(continued next page)

Evaluating the Characteristics of Good Teaching: An Example

An example of how the various characteristics of good teaching might be evaluated systematically by different groups is provided in a recent monograph developed at Syracuse University (Centra, et al 1987). After selecting, from previous studies, the general characteristics to be evaluated, the Syracuse group identified seven ways the data could be collected and the six individuals or groups to do the evaluating.

The seven methods were:

- Self-assessment/report
- Classroom observation
- Structured interview
- Instructional rating survey
- Test or appraisal of student achievement
- Content analysis of instructional materials
- Review of classroom records

These could be evaluated by

- Self
- Students
- Faculty
- Dean or department chairs
- Alumni
- Other appropriate administrators

For the characteristic, "Good Organization of Subject Matter and Course," for example, faculty could observe a colleague's classes to judge such specifics as whether the teacher had made a clear statement regarding the purpose of the lesson and whether major points of the lesson had been summarized.

Student evaluators could be asked to judge this same characteristic by responding to such rating survey questions as the extent to which the instructor was prepared for class and presented topics with a logical progression. As a third possibility, a department chair or another person might do a content analysis of the course syllabus.

Each method and each evaluation source has its advantages and disadvantages. Consider, as an example, the following advantages and disadvantages of classroom observations by colleagues as discussed in the monograph (p. 23).

Advantages

Classroom observations help to complete a more concrete and real picture of the instructor than usually appears with the use of only indirect methods, such as student ratings and administrator comments. Sometimes student ratings can be inconsistent for controversial instructors or situations, and classroom observations can provide information regarding the ratings. Classroom observations also allow a more extensive focus on substantive course content issues, such as relevance and knowledge of subject matter, scholarship, and integration of topics.

Disadvantages

There are several disadvantages to classroom observation. First, faculty tend to find it threatening to implement classroom observation when they have never used the method before. As a result, this method demands considerable tact, respect, and rapport among faculty. Second, it requires considerable faculty time to ensure that the number of observations necessary to make conclusions reliable and valid are made. Third, observations for personnel decisions must be kept separate from observations for instructional improvement decisions to protect the use of this technique for either purpose. Fourth, observers tend to vary in their definitions of effective instruction making it difficult to derive consensus regarding observations. Training observers is, therefore, recommended.

The advantages and disadvantages of the various approaches to evaluating teaching underscore not only the complexity of making evaluations but of teaching itself.

Teaching is more complicated than a list of qualities or characteristics of good teaching implies. The Syracuse monograph, which was written for department chairs and members of tenure and promotion committees in particular, discussed several caveats. In the first place, some of the characteristics are more easily measured than others, and this could result in such characteristics getting more weight than they deserve. Secondly, teachers will display different patterns of strength, and a good teacher will be strong in many of the characteristics identified but not necessarily all of them. The ultimate outcome of good teaching—beneficial student learning—might be achieved through a variety of approaches.

The Scientific Basis for Teaching

The fact that there is strong consensus between and within various groups about the characteristics of effective teaching does not in itself, establish teaching as a science. Webster's dictionary defines science as:

> *Knowledge acquired by careful observation, by deductions of the laws which govern changes and conditions, and by testing these deductions by experiments.*

Does teaching have this kind of scientific basis? Gage (1978) argues that there is a scientific basis for the art of teaching. A science of teaching, according to Gage and as the Webster definition implies, requires rigorous

laws that yield predictability and control. The research on teaching at the elementary/secondary level, which Gage draws largely on to reach his conclusion, has not attained that level of predictability. Because of the complexity, "any singly significant variable in teacher behavior should have only a low correlation (ranging from ± .1 to about ± .4) with student achievement or attitude" (Gage, 1978, pp. 26). The same can be said of the college teaching characteristics which correlate in a similar .1 to .4 range with course-level achievement when student ratings have been used to assess or describe instructional variables, (Centra, 1977, Cohen, 1981).

In research on teaching, it is apparent that laws or theories relating any two variables need to be modified to include other variables as well. These interactions do not only occur in research on teaching but even in the natural sciences when real-life rather than laboratory phenomena are studied (Gage, 1978). Thus, the fact that research on teaching has not produced highly predictable results does not in itself negate a scientific basis to teaching. Other practical fields and professions, in addition to teaching, have a scientific basis but require "artistry" to reach desired ends. Gage mentions medicine and engineering as examples. Practice in both fields requires knowledge of much science—"artistry enters into knowing when to follow the implications of the laws, generalizations, and trends, and especially, when **not** to, and how to combine two or more laws or trends in solving a problem" (Gage, 1978, pp. 18). College teachers, it would seem, need to be aware of the scientific basis of teaching, as well as when and how to build on that basis.

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*A longer version of this paper will be published in the Jossey-Bass series, New Directions in Teaching and Learning.

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DOUGHTY RESPONDS TO INVITATION TO VISIT GOVERNMENT REPRESENTATIVES AND FACULTY IN THE PEOPLES REPUBLIC OF CHINA: A GREAT OPPORTUNITY WITH CONSIDERABLE POTENTIAL FOR COLLABORATION—BUT WITH POOR TIMING

A visit in Shanghai and Beijing with faculty members of educational technology and adult education programs combined with discussions about collaborating with the Peoples Republic of China's ten regional educational technology support centers was an offer that could not be resisted. In Shanghai, several days of faculty meetings, field trips to continuing education sites in manufacturing plants, and discussions with regional officials interested in improving the training of mid-level managers all offered promise and mutual benefit.

In Beijing, meetings with educational technology association members, along with university faculty and administrators interested in computer-based instruction, distance learning via video and computing conferencing also suggested a bright future. Meeting with ministerial level officials responsible for staffing and directing their ten regional educational technology and communications support centers were exceptionally exciting. Opportunities for faculty exchanges, joint staff development projects, sharing of instructional materials and production support techniques were evident.

Many toasts were offered, unbelievable numbers of entrees were consumed during every meal, many professional cards were exchanged, plans were laid for immediate followup, and multiple requests for student admission forms were received. All appeared to be ready for an exciting multiple institution and government agency collaboration. Subsequent (two weeks later) events have limited the contacts. Planned visits to Syracuse by university presidents, faculty and manufacturing plant managers have been "postponed". Several faculty have come for three- and six-month exchange visits. The future is cloudy. The interest, prospects and promise remains.

The Diffusion and Implementation of Educational Technology in Developing Nations: Cross Cultural Comparisons of Indonesia, Chile and Peru

*Donald P. Ely**

Most research studies begin with curiosity—curiosity about an observation, an experience or a convergence of isolated factors. Most research studies do not begin from scratch—somewhere, sometime, someone has thought about the question and has explored it to some degree. Most research studies begin with hypotheses, probably not fully developed or stated in classic experimental fashion. Most research studies have a general idea about procedures to follow in exploring a question but changes are usually made en route, especially in the social sciences where people are involved. Most research studies expect to reveal something new; there is anticipation of a contribution even though some report "no significant differences" or have to reject the original hypotheses. These were the conditions that preceded this study. They were manifested in several ways.

I was **curious** about the status of educational technology in three countries where I had spent a great deal of time over the past thirty years: my first contact with Indonesia was with a graduate student from that country in 1958 and I have worked there almost every year since 1979 for periods of three weeks to three months. In 1963, I was a Senior Fulbright Lecturer in Chile for about nine months and in 1975 I served on a Fulbright team in Peru for three months. I have returned to Chile and Peru on other occasions since my first appointments and have continued to be in communication with professional colleagues in each of these countries over the years. I began to wonder if the field of educational technology had made any progress in those countries (and, incidentally, if my contributions had made any difference). I was curious about the cross-cultural similarities and differences between Indonesia and the two Latin American republics. Developing nations are often grouped together and are treated as one Third World unit. I wondered if there are similarities and differences in educational technology as it is practiced in each country. I wondered if educational technology even exists and the nature of its activities. If educational technology has been adopted in various sectors of the society, what are the factors that have facilitated the acceptance and implementation? If it has not been adopted, what are the factors that seemed to hinder its acceptance and implementation?

When a person begins to focus on a research question (or almost any inquiry for that matter) it seems that all of a sudden new information becomes visible. An Indonesian educational technologist had received support from UNESCO in 1984 to study the growth and development of the field in his country. He had interviewed important persons in the United States, the United Kingdom, and Indonesia who had been associated in some way with the development of the field in his country. Tape recordings of all 37 interviews were available and constituted a major resource. Two Chilean educational technologists, Arturo Kotesky and Patricio Calderon, had written an article in 1983, "Development of Educational Technology in Chile," and a specialist from the Multinational Project on Educational Technology, Clifton Chadwick, who was active in the project from Santiago, provided the names of more than twenty professionals who are active in the field. A visit to Florida State University revealed the dissertation of Cassandra Fletcher, Educational Technology in Peru, 1968-1980: A Case Study of Diffusion of an Innovation Within a National Education System (1984). Each of these resources offered extensive reliable information for this study. Each source also provided the continuity needed between the researcher's first contacts with the country and the current state of the field's development.

Beyond the curiosity about the current status of the field was a series of hypotheses about the **conditions that facilitate the implementation of educational innovations.** In this case, educational technology was the innovation. In 1976 the researcher published an article: "Creating the Conditions for Change" in which seven "conditions" were posited as necessary for institutional change to occur. Since that time, through experience and through review of the literature, those conditions (and one additional condition) appear to be valid. This study offered the opportunity to further test the conditions in a cross-cultural context. Each condition seemed to hold true for North American Educational institutions, but what about other areas of the World?

Out of this curiosity, background information, and hypotheses about conditions that facilitate the implementation of educational innovations, I generated a series of objectives that I wanted to attain in the hope that I could gain an understanding about the current status of the field in three developing nations and perhaps come up with some generalizations about conditions of change that could be used in other contexts.

Objectives of the Study

1. *To determine the extent of educational technology presence in each country.* Where are the centers of activity? Who leads them? How long have they been in operation? What do they do? What changes have occurred over the years? Do they appear to be secure for the foreseeable future?
2. *To identify the networks, if any, through which the concepts of educational media and technology have been disseminated.* Who are the opinion leaders? Are they associated with the primary nodes of the networks? Are people associated with one agency, program or organization more likely to be the source of innovative ideas and responsible for spreading those ideas throughout the country? Are there formal channels, such as professional associations, publications or meetings, through which educational technologists communicate? Are there organizations that assume dissemination responsibilities for the nation? Do any social networks exist among opinion leaders and gatekeepers?
3. *To determine reasons for acceptance (and rejection) of educational technology where it has been introduced.* Also of interest is any change that may have occurred between initial acceptance and later rejection. Why did the change occur? To what extent did financial support determine acceptance or lack of support, rejection? What factors are responsible for continuation?
4. *To test a series of hypotheses regarding conditions that facilitate or hinder the implementation of educational innovations, specifically, educational technology.* The premise is that the presence of eight conditions is necessary to implement change once an innovation has been introduced and adopted. The presence of all eight conditions would indicate high probability of sustained implementation. Reduction of the conditions would lessen the probability of continuation.

Research Procedures

To approach these objectives and the related questions required direct primary data and those data can be obtained mostly from people in the countries being studied and literature that exists only in each country. A combination of research methods must be used: **historical** methods help to determine the "then and now" comparisons that are necessary to view development of the field over time. In this study, a 25 year period is used; **case study** methods probe institutional dynamics and this study is primarily an inquiry into organizational acceptance and application of educational technology; and **descriptive** methods permit individual expressions of experience, observations, and interpretations. Each of these methodologies contribute to the over all data gathering procedures and each provides a different perspective on the same questions.

Translating research methodologies into actual data gathering mechanisms is where ideal and practical approaches part company. After 25 years, where are the people you once knew? Who are the active professionals currently—and where you find them? What networks exist, if any, and how do you tap into them? Where is the literature that does not find its way into libraries?

The key to most of these questions is the network which the researcher has built-up over the years. By maintaining contact with individuals in the countries being studied, there are initial points of contact. From those points come others. For example, the 40 or so Syracuse University graduates in Indonesia are obvious starting points; a professional colleague who worked in the field in Chile for almost 15 years can name people who ought to be interviewed; and the Fulbright Commission office in Peru has sponsored half a dozen U.S. educational technologists to teach and study there over the past 15 years and their names are known. With such networks, the first phase of contacts begins and from that first wave comes a flood of additional names of people to contact and interview. In each country, the time expired before the list of names was exhausted.

Data Gathering

The primary source of information for this study was individual educational technologists and other educators who were interviewed by the researcher. Using a structured interview based on the objectives of the study, people were queried about the state of the field and their specific activities in relation to educational technology. Most of the interviews occurred in the work place so it was often possible to see special facilities and to meet other people, some of whom were interviewed. During the interviews, each person was asked about reports, evaluations, published materials and other written matter that might provide further insight into the development of the field in that country. These individuals, their colleagues, and the literature that they identified provided the bulk of the data for this study.

Findings

There are findings that are specific to each country and

there are findings that are generalizable across all three countries studied. These are the general findings.

1. Educational technology is more of a **movement** than a field. Local definitions are emerging and they tend not to be North American definitions. The characteristics of a profession are not yet observable: a strong national professional association; high level of communication among practitioners; a body of research; standards for professional training; a code of ethics—none of these elements appear to be sufficiently strong in the three countries studied to say that educational technology is a field. The definitions and perceptions of the field are even more diffuse. The dominant perception is that educational technology equals hardware; that it is a mechanistic invention of the more developed world that is being thrust upon the developing nations; that it is more interested in systems than with people; and that it is contrary to local social-cultural values.
2. Efforts to transfer North American versions of educational technology have been met with some resistance if not hostility usually based on socio-cultural conflicts. The perceived nature of educational technology is that it is revolutionary and requires major changes of organizational behavior, especially in the schools. Such change is viewed as cataclysmic and inappropriate for people who have defined the nature of education for their own people.
3. Even with the cautions, there is an emerging group of people who say they are educational technologists even though they have no formal training in the field. Most of these individuals are computer specialists who demonstrate the same zeal as media specialists did two decades before. They are more numerous and more pervasive than any of the earlier advocates of educational technology. They are found mostly in post-secondary institutions, private schools, business and industry, and government.
4. Many of the people who were trained in educational technology are well-placed in positions but are not doing what they were trained to do. They have become administrators, managers, and government officials and tend not to serve in the schools. Apparently their knowledge and skills have some value in other sectors.
5. There are networks of people in the field of educational technology. Most of the networks seem to follow patterns of university training. For example, in Indonesia, there is an active network among educational technology graduates from Syracuse University; in Peru, there is a network among graduates of Florida State University; and in Chile, there is a combination of graduates from Florida State University, Teachers College (Columbia University) and Pennsylvania State University. Other networks tend to be at job levels, e.g., higher education, medical schools, business and industry trainers, and so forth. People who are working in the field seem to look to North America for trends, new ideas, and new products. There is evidence of assistance from Japan, Germany and The Netherlands in each of the countries studied. Most of such assistance is in the form of products.
6. The reasons for acceptance of educational technology are closely related to the conditions that facilitate change. **There has been leadership.** One person or one agency championed the diffusion effort. In some cases the original leader trained successors thus continuing the original program; in other cases, the departure of the leader led to decline of the organization or movement.
   Another reason for acceptance and implementation has been the **perception of modernization** on the part of educational and government leaders. Using the Western model of problem-solving through technology, many countries purchased communication hardware that symbolized progress. It could be seen and touched. It was the same equipment that was being used in the more developed nations and therefore conferred status on the owner. Little thought was given initially to the software or materials required to use it or to the methods of utilization. When time came to demonstrate some of these new acquisitions, it was poorly done and at such expense that cost questions began to be asked.
   Still another reason for acceptance and implementation was the promise of providing **equal access** to educational opportunity. The success of mass media in education in other countries and the visible applications in such innovative organizations as the British Open University, caused leaders faced with educational problems a potential solution to local concerns. Technology was a component of innovative educational programs in other countries; why not in "our country"? It offered a promise that no other reform could make in such a short time.
7. Most of the **conditions** that facilitate change were present in each country: dissatisfaction with the status quo; the need for knowledge and skills by the users; the need for resources; the need for leadership; and commitment to the innovation. However, the other conditions were not as strong in some of the countries. The need for rewards or incentives was weak in Chile and Peru but strong in Indonesia. Participation in the implementation of educational technology was weak in Chile and Indonesia but strong in Peru. One could speculate on the reasons for the strengths and weaknesses of the conditions but this analysis is best saved for another paper.

Conclusions

Educational technology is alive but not so well in Chile,

Peru and Indonesia. There are many diverse applications of media and instructional development in various sectors of each society but no unifying concept. Most of the principles and practices that are evident have been transferred from the more developed countries of the world. A major barrier to acceptance of educational technology is the lack of understanding on the part of decision-makers. Advocates for the field have not been able to penetrate the thinking of those who make educational decisions. However, there **are** professionals in the field in each country; there **are** university-level courses and programs to prepare professional personnel; there **are** publications in the local languages that contain contemporary concepts about the field; and there **are** networks through which people communicate about new developments and applications of educational technology.

Educational technology is being defined (and must be defined) in the cultural context of which it is a part. When the manifestations of the field are observed in developing nations, they are often interpreted as cultural and technological imperialism of the more developed countries. Basic media (hardware and some software) and instructional design, development and evaluation procedures can be borrowed from other settings but ultimately they must emerge as indigenous innovations that are uniquely fitted to the local society and culture.

The conditions that facilitate the implementation of education technology in Chile, Peru and Indonesia are: (1) dissatisfaction with the status quo; (2) knowledge and skills of the users; (3) resources to do the job; (4) leadership to support and direct the effort; and (5) commitment to accomplish the goals. Less important conditions seem to be: (6) the need for rewards or incentives; (7) time to prepare for the task; and (8) participation in the process of implementation. The conditions vary with the country and with the nature of the innovation.

For me, the study confirmed the development of educational technology in each of the countries studied but the extent of the development was somewhat disappointing. I am not the first to make this observation.

> "For more than a hundred years much complaint has been made of the unmethodical way in which schools are conducted, but it is only within the last thirty that any serious attempt has been made to find a remedy for this state of things. And with what result? Schools remain exactly as they were. "The Great Didactic of John Amos Comenius" 1632.

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RESEARCH LABORATORY FOR INTERACTIVE LEARNING

Increasingly, the state-of-the-art design, development, and implementation of advanced learning technologies is moving away from our schools of education and into the private sector. In spite of schools being in crisis and priority being placed on improving schools by the year 2000, experimentation on the uses of advanced technologies are more common in the workplace than in schools, and two-way video teleconferences more frequent between regional boardrooms than classrooms.

In an effort to maintain a leadership role in this rapidly changing field of education, Syracuse University's School of Education has established the Research Laboratory for Interactive Learning, under the school's Department of Instructional Design, Development, and Evaluation. The lab is dedicated to providing a blend of expanded research opportunities into interactive learning theory with hands-on demonstration and evaluation of applications of state-of-the-art technologies in educational environments. Specifically, the lab houses a number of advanced interactive, computer-based learning systems and materials to support both its research and teaching goals.

Several research studies are already underway, exploring learner attributes and instructional intervention strategies using both interactive video and CD-ROM technologies. Laboratory-based activities have also been incorporated into several courses in instructional design, instructional product development, teacher training, and course evaluation.

In an era where the future is literally tomorrow, the Research Laboratory for Interactive Learning is providing a crucial experimental and research capability to ensure that Syracuse University remains at the forefront of leadership in the field of Education and Instructional Technology. Further information may be obtained by completing and returning the coupon on the last page of the journal.

Programmatic Research and Development at Syracuse University: The IDD&E Working Paper Series, 1980-1990

*Charles R. Dills**

Syracuse University has long had a reputation as a center for research and theory building activities leading to marked improvements in application and practice. Much of this progress has been due to the practice of programmatic research—that is, a series of closely related studies and projects dealing with a single broad question, with such work continued over a period of time and involving several different researchers. An outstanding example of such a program at Syracuse University is the research that has been conducted on instructional design and development models within the Instructional Design, Development and Evaluation (IDD&E) Program.

The current program of research has been underway for over ten years. The goals for this series of studies was first set down in a publication of IDD&E written in 1980 by Charles Reigeluth, Toward a Common Knowledge Base: The Evolution of Instructional Science. The rationale and justification of this programmatic approach was stated in 1987, when Charles Dills and Alex Romiszowski published a paper, called In Search of the Elusive ID Research Study, Or How Do We Know When (If) We Are Doing ID?

The two papers, taken together, provide a fairly adequate description of what has been happening in the IDD&E over the last ten years. The programmatic approach to involving students and faculty members in a long-term effort to develop an instructional science has been fairly successful. Early versions of several instructional design models, and much new knowledge concerning such design issues as sequencing, presentation formats, motivational design, adjunct devices, and the design of instruction for new technologies have been produced through the research program.

One of the best ways to view the research program is through a series of pre-publication reports put out by IDD&E Program. Called the IDD&E Working Papers, the series was begun in 1980 and is still in active production. The papers in this series are designed to provide researchers and developers in instructional design and development with preliminary versions of articles to be eventually published, and with descriptions of research studies conducted at Syracuse University that may not be published elsewhere (such as pilot studies or tests of very micro-level theories concerning design science). Since all issues (there are currently 26 of them) have remained in print, the progress that has been made in developing and testing Reigeluth's design science can be traced.

Certain themes may be identified among the Working Papers. One of the major topics of research has been the study of sequencing and its effects upon cognitive learning. The second paper in the series (April, 1980) was a study of sequencing, and this theme is repeated in various forms in 1981 (Paper #5), 1982 (Paper #7), 1983 (Paper #8 and Paper #12), and 1985 (Paper #19). These papers dealt with various facets of the sequencing problem, ranging from the sequencing of embedded questions (Paper #7), to the sequencing of lesson elements in concept learning (Paper #5 and #8), to the question of how to sequence principles and procedures within a single lesson.

Non-sequencing aspects of the same topics studied under sequencing were also dealt with. For example, other aspects of adjunct and embedded questions were examined by Harry Mouton and Charles Reigeluth in a 1987 paper (Paper #24), Adjunct Questions and Mediated Self Instruction: Comparisons of Lookback and No-Lookback Procedures, with High or Low Level Questions, Massed or Inserted in the Text.

The instructional design theory of Motivational Design, formulated by John Keller and generally known as the ARCS Model, appeared early in its history in the Working Paper series. Keller published Paper #10, March, 1983, in which two research studies on the use of the ARCS Model by teachers were presented (Use of the Arcs Model of Motivation in Teacher Training, by John Keller) and in August of the same year, Keller published a review of other people's work in the field of motivational design, pointing out areas needing research (Motivational Design, by John Keller).

Another example of a common thread running through the papers is given by the very first and the very last of the papers; much of the work carried out over the ten-year period at Syracuse has been motivated by the writings of David Ausubel, especially his Theory of Meaningful Verbal Learning. Paper #1 in the series, Meaningfulness and Instruction: Relating What Is Being Learned to What a Student Knows (Reigeluth, March, 1980), Paper #9 by Ruth Curtis and Charles Reigeluth (The Effects of Analogies on Student Motivation and Performance in an Eighth-Grade Science Context, March, 1983), and the latest paper in the series, Why Don't Advance Organizers Facilitate Learning More Often: A Review of Some Methodological Issues? (Charles Dills, February, 1990) are all examples of work inspired by Ausubel.

The development of data-based and conceptually sound design models and procedures for the newer technologies is also an on-going concern at Syracuse University, and has been for some time. This concern has seen expression in several Working Papers, such as Paper #11, directed at design questions involving computerized instruction (The Effects of Three Different Kinds of Feedback: Hint, Correct Answer, and Right/Wrong, April, 1983, by Betty Feng and Charles Reigeluth), or Paper #23 (An Instructional Theory for the Design of Computer-Based Simulations by Reigeluth and Schwartz, June, 1987).

These and the other papers in the series not only trace the history of the programmatic effort to develop an instructional design science at Syracuse University, but provide valid and very useful findings, recommendations and models for the conduct of instructional design and development which in many cases have yet to be made available elsewhere in the literature. And they provide the foundation, in part, for the on-going research and study currently underway at Syracuse and other universities that was motivated by the early papers of the series. As further results are obtained from the program of research, and further Working Papers become available, the series will be of even more value to researchers and practitioners in the field who want their work to be both conceptually sound and empirically based.

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Copies of the above mentioned **IDD&E Working Papers** may be obtained by completing and returning the coupon on the last page of the journal. The cost of photocopying is $1.00 for each. Please add postage and handling costs of $2.00 for orders of up to 3 copies, $4.00 for 4 to 6 copies and so on pro-rata. The cost of postage and handling for international mailings should be doubled. Orders should be accompanied by a check for the total amount, made out to Syracuse University. The full list of titles in the Working Paper series is as follows:

1. Meaningfulness and Instruction: Relating What Is Being Learned to What A Student Knows by Charles M. Reigeluth. (March 1980)
2. Relating What Is To Be Learned To What Is Known: Subsumptive Sequencing, Coordination, and Cognitive Strategies Activation by Faith S. Stein, Jody K. Witham, and Charles M. Reigeluth. (August 1980)
3. Toward a Common Knowledge Base: The Evolution of Instructional Science by Charles M. Reigeluth. (August 1980)
4. Using Videodiscs In Instruction: Realizing Their Potential Through Instructional Design by Charles M. Reigeluth and Joanne M. Garfield. (September 1980)
5. The Use of Sequence and Synthesis for Teaching Concepts by Linda Frey and Charles M. Reigeluth. (December 1981)
6. A Comparison of Three Instructional Presentation Formats by Bonnie Keller and Charles M. Reigeluth. (January 1982)
7. Type and Position of Adjunct Questions: Their Effects on Memory and Application by Afnan N. Darwazeh and Charles M. Reigeluth. (February 1982)
8. The Effects of Sequence and Synthesis on Concept Learning Using a Parts-Conceptual Structure by C. Herbert Carson and Charles M. Reigeluth. (February 1983)
9. The Effects of Analogies on Student Motivation and Performance in an Eighth Grade Science Context by Ruth Curtis and Charles M. Reigeluth. (March 1983)
10. Use of the Arcs Model of Motivation in Teacher Training by John M. Keller. (March 1983)
11. The Effect of Three Different Kinds of Feedback: Hint, Correct Answer, and Right/Wrong by Betty Feng and Charles M. Reigeluth. (April 1983)
12. Effects of Four Instructional Sequences on Application and Transfer by Chun-I Chao, Luz Ruiz, and Charles M. Reigeluth. (May 1983)
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15. Motivational Design by John M. Keller. (August 1983)
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24. Adjunct Questions and Mediated Self Instruction: Comparisons of Lookback and No-Lookback Procedures, with High or Low Level Questions, Massed or Inserted in the Text by Harry Mouton and Charles M. Reigeluth. (March 1987)
25. In Search of the Elusive ID Research Study, Or How Do We Know When (If) We Are Doing ID? By Charles R. Dills and Alex Romiszowski. (November 1987)
26. Why Don't Advance Organizers Facilitate Learning More Often: A Review of Some Methodological Issues? By Charles R. Dills. (February 1990)

Computer mediated communication

An overview

*Karen Lee Jost**

Uses of CMC

Computer mediated communication has been used primarily as a user-driven conference system (hence the popular term "computer conferencing"). This implies that a group of individuals exists, who choose to debate a topic of mutual interest. They may be in search of new ideas and may view a change in the direction of the discourse as a positive development. Also, individuals may join in or drop out of the discourse, in relation to their own interest in the main topics under discussion. The continuance of the discussion is controlled by the existence of a "critical mass" of interested discussants.

Another common use of CMC, is as an information system, as exemplified by the proliferation of bulletin board systems. Their primary purpose is to offer a special-interest-group information-sharing service.

A growing use of CMC, is as a social communication system. This use is of growing importance in distance education. It provides students with the opportunity of social interaction with other students, which is often a missing component in distance education. The experience of the British Open University, in using CMC for a year on a course with over 1200 students, showed that from the students' point of view, this was the most used and most valued function of CMC (Bates, 1988).

At Syracuse, the main interest has been to examine the use of CMC as part of an instructional system. CMC has great potential as an instructional system in both distance education and on-campus courses. As an instructional methodology, CMC can solely deliver a course or can supplement other instruction (Romiszowski & Jost, 1989). However, it has been demonstrated that the harnessing of CMC systems to the achievement of specific educational outcomes, requires careful design and implementation (Davie, 1988; Lauzon and Moore, 1989).

Use of Email vs. a Conferencing System

Some conferencing systems provide a complex structure to help organize the materials of the conference (or course). The structures are generally set up using some kind of metaphor of an educational system.

Apart from the difficulty of learning the technicalities of using the system, students often input comments in ways that do not fit well into the existing structure. This creates the need for a course "moderator" (who may or may not be the instructor) to regularly monitor the incoming messages and transfer some to new sub-conferences or small-group discussion spaces. This task must be done regularly, otherwise many participants may respond to a "maverick" comment and distract the attention of all from the mainstream discussion, possibly irretrievably. It must also be done skillfully, otherwise many participants may disagree with the structure being imposed by the moderator and may feel that the conference is being "censored" in some way.

A simpler and more generally available alternative to the use of a specially structured conferencing system, is Email. Within the department of Instructional Design, Development, and Evaluation, we have been using Email systems in conjunction with Bitnet, to run several CMC conferences and seminars, often linking several internationally located sites. No attempt was made to impose a centralized structure through the system. Indeed, the limitations of the Email systems we have been using prevent us from doing this. We have not, therefore used moderators, although the instructors involved would attempt to define an initial structure in an opening "position paper". We have then encouraged each of the participants to map their own view of the emerging structure.

Characteristics of CMC

The asynchronous nature of the communication process in CMC, has been found of educational value in interactions between persons who are prevented from meeting face to face by distance. Unlike face-to-face instruction, or real-time teleconferencing, in which the participants communicate during one fixed period of time, CMC allows one to choose when to respond to another participant's comment. This offers the benefit

of allowing one to think out a more structured, more complex response, and the benefit of being able to participate at times that are personally convenient. This same factor can also generate communication difficulties. One problem is that it may promote procrastination, leaving the response for later, and perhaps in some cases, failing to respond altogether. This adds to the complexity of the developing structure in that students may, at any time, be inputting new comments related to different stages of the development of the topic. Not only is the discourse "multi-level" in that several different topics may be in simultaneous discussion, but it is also "multi-speed."

Another problem originates from the distance communication aspect of CMC. Although distance communication allows one to participate in a discourse which may otherwise be impossible, it also introduces some difficulties of control of the discourse. The instructor loses some of the benefits offered by a face-to-face group situation. When the discussion drifts off the topic, it often takes longer, and is more difficult, to bring the group back on task. Several instructional strategies for dealing with these challenges have been experimented (Romiszowski & Jost, 1989).

Using Computer Mediated Communications for Instruction

Computer mediated communication is a qualitatively different medium for instruction. When designing instruction for CMC, it is important to consider the strength of the medium and to focus attention on the learner.

There are many benefits claimed for using computer mediated communication in education: a democratic environment for group interaction and learning; a record of the entire course; students don't miss any of the instruction due to absenteeism or daydreaming; more students respond to questions and ideas; the responses are longer and more complex than in a traditional classroom; the students learn from each other; teacher comments become more interactive (Romiszowski & Jost, 1989).

Within the School of Education, there are a number of faculty and graduate students who are using CMC in delivering courses or as a supplement to instruction. Both the instructional potentials and the benefits of social interaction are being examined. The following articles by Tom Green, Barbara Florini, and Barbara Grabowski, all testify to the benefit of using CMC to engage learners in discussion and information sharing, with the additional benefit of receiving feedback and responses that are timely and from a wider audience. The article by Alexander Romiszowski describes continuing research on developing techniques for organizing and structuring the discourse. Current work is focusing on the design of a CMC-organization tool, a hypertext environment, which could reside on the disk of a participant's computer.

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Computer mediated communication

Philo's Workshop

Tom Green *

Philo's Workshop is simply a text, a teacher, and a set of routines. The text, in short incremental sections, is entered as a file in the main-frame computer. Students are invited to comment on it at any point. A single key stroke opens the screen for them to enter their remarks, and when they are finished, another key stroke will send the remarks to Philo to add his own response. When Philo posts the comments in a second file, his own remarks of criticism, guidance, encouragement or instruction are entered right in the midst of the student's own, and when this entire exchange is posted a public file of comments for all to see, they are accompanied with seven lines of text surrounding the line which prompted the original remarks of the student, thus preserving the context of the exchange. These routines of text, comment, and instructional response are applicable at any point. Thus students can comment on student comments as well as upon the text itself. Hence, instruction occurs in relations of one to one, one to many, and many to many.

Although Philo's Workshop is currently used at Syracuse University to give instruction in doing philosophy, it can be used for any course in which there is text, in which comment and practice in discursive writing are central to the pedagogy.

The idea of Philo's Workshop took shape originally during the Spring of 1988. It was stimulated by two considerations. There was, on the one hand, the sheer fun of learning to use Bit-net in exchanges with friends at other Universities.

On the other hand, was the dismal realization that more and more, neither graduate students nor faculty members had had any experience in the kind of disciplined thinking about educational topics that conceptual analysis or the so-called linguistic turn might provide. Much of what came to be the content of Philo's Workshop had been the central material for a popular graduate course taught at Syracuse in the mid-sixties, often with classes of more than one-hundred, sometimes nearly two-hundred. But that course, in that form, had not been taught with regularity for more than a decade and there was currently no provision for students to gain experience of the sort that it used to provide.

Bit-net was significant not simply because it was fun. Using it also expanded my circle of philosophical conversation-partners and raised the quality of that conversation far above anything I could achieve at professional meetings where thought is often fleeting, encounters are momentary, responses must be verbal and immediate, and arguments, of necessity, cannot be pursued in depth. Besides, electronic mail seemed to "grab" my attention and draw forth response even though letters and other communiques often lay on my desk unanswered for weeks. All of these matters, I thought, might be altered if something like electronic mail could be used not simply for idle chatter, but for developing serious argument. I began to think of myself as engaged in a kind of seminar with a professor at Cornell, others at UCLA, the University of Virginia, Rutgers and who knows to how many others this might extend. Why not allow students the same pleasures and advantages of engagement in argument, writing, with rapid exchange even while gaining some skills of thought?

Returning to a course in ordinary language analysis seemed just the thing to do. First, because the rudiments were already lying around, but secondly, because understanding what philosophy might contribute to one's professional life was so rare a thing among both students and faculty colleagues, and because their misconceptions of philosophy were already so outrageous, I felt that doing so could not possibly do any harm.

So I asked for help in learning how students might be given a text on which to comment and, in turn, receive comment and directions from a skilled teacher in return. The result was Philo's Workshop.

The thought was that the technology must become so simple (as easy to learn as turning on the radio) that actually doing philosophy would become the focus of attention, not learning to use the computer, not acquiring any doctrine or any body of information. Another thought was that the computer must not be used simply as substitute for text. That is, just sitting at a terminal and reading is no gain over the older, still noble and valuable technology of the book. The central activity must be simply, response. And that response must in turn, gain the response of an attentive teacher, and mistakes must be evident to all if skill was to be devel-

oped. Hence, the routines of Philo's Workshop.

These pedagogical observations can be elaborated. But doing so would in itself require an extensive piece on the nature of philosophy. It will suffice here to say that there is a single intellectual turn on which the skills of analysis are dependent. It is the shift from the material to the formal mode of discourse. Thought becomes reflexive. The method is a method of examining speech. its syntax mostly, but also its social context and the use of speech is itself a social act. Making this turn intellectually, not simply talking about it, is the single methodological requirement of the workshop, the single move that, taken by students, evokes Philo's permission for them to turn the discussion to whatever educational topics they care to entertain.

Whether this works and, if so,then how and to what extent can not be judged by anyone. Students in the last offering of Philo's Workshop joined to write a genuinely joint paper on the pedagogy of Philo's Workshop. Copies are available by Email, Bit-net, or in hard print together with an "Overview."

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Computer Conferencing

Barbara Florini *

The Adult Education Program at Syracuse University is among the growing number of educational and other institutional users exploiting computer-mediated communication's (CMC) instructional potential. Specifically, the Syracuse Adult Education Program has been introducing computer conferencing technology to better accommodate students with full-time jobs and other constraints that preclude routinely attending on-site classes at specified times. The Open University in the United Kingdom, the Ontario Institute for the Study of Education at the University of Toronto, and the New School for Social Research in New York are just a few other educational institutions using computer conferencing for instructional delivery.

Like electronic mail, the prime attraction of computer conferencing is that widely dispersed people can communicate quickly and asynchronously. That is, no one need be online at the same time because a central computer, virtually always available, stores messages until the intended recipients read and otherwise act on them. Computer conferencing requires a program installed on a host computer. Conferencing participants generally use microcomputers equipped with modems and telecommunications software to connect with this host.

Conceptually, computer conferencing is rather like holding a traditional convention with both plenary and simultaneous small group sessions, except that individuals can participate in all sessions when personally convenient. Each meeting session is held in its own electronic room or space. These are labeled by session name just like meeting rooms at traditional conventions, so you always know where you are. Because the record of all previous discussion for each session is continuously available, no participant is disadvantaged by joining discussions in progress.

Educators can similarly use computer conferencing for holding courses and training sessions. Instructors can arrange the electronic space as they choose with full class sessions, small group work, and private communication taking place at the convenience of instructor and students. Busy adult learners quickly appreciate the flexibility computer conferencing introduces to class participation. Even though students in the same course need not gather at a particular time and place, class members engage in group discussions and private conversations with individual classmates or the instructor and, also, socialize amongst themselves—all possible because computer conferencing facilitates group participation asynchronously.

Students need only elementary computing skills for computer conferencing-based courses. In our experience, students having very limited or no previous computer experience took about two hours to develop the skills needed for initial class participation. Students already accustomed to electronic mail took rather less time because our conferencing program, "Participate," has an effective built-in tutorial as well as good on-

screen help information. If necessary, instructors can provide additional training during a course on an individual basis as needed.

Instructors, too, need little previous computing experience in order to provide conferencing-based courses. Although the various commercially available computer programs differ in their particular features and benefits, they are generally no more difficult to use than the better word processing programs. Like learning to use these, instructors can concentrate on learning the few features most commonly used and then acquire greater sophistication on an as-needed basis.

Through computer conferencing technology, instructors enjoy appreciable control and flexibility when arranging an electronic classroom space. Using many advanced technologies, like videotaped lessons, often requires special planning as well as collaborative efforts with technical support personnel. Instructors teaching computer conferencing-based courses, on the other hand, enjoy an autonomy similar to what they enjoy in a site-bound classroom. Within the electronic space, instructors can arrange numerous concurrent activities—large and multiple small-group discussions, private message exchanges, and student socializing—that can take place throughout the course's term.

My own computing skills are largely self-taught and not especially sophisticated. Yet I found it took little time to become comfortable arranging electronic learning spaces into various configurations suitable for instruction. Once our computing services installed the conferencing program on its host computer, there was no need to call on their further expertise for help in running the program. Thus, instructors generally still enjoy their traditional classroom freedom and flexibility when teaching conferencing-based courses.

Computer conferencing has limitations as an instructional delivery tool. It appears particularly appropriate for courses where discussion, rather than other methodologies, plays a major role. Other limitations are due to the state of the art, which continually changes. But there are also many unanswered questions regarding conferencing's suitability for various content types and different teaching and learning styles, as well as questions about using methodologies other than discussion. For further consideration of these and other issues, see the Canadian Journal for Educational Communication, 16 (2) and Mindweave : Communication, Computers and Distance Education, R. Mason & A. Kaye, eds. 1989, Pergamon Press.

Nonetheless, computer conferencing already plays an educational role that will grow significantly for two reasons. First, the necessary combination of telecommunications and computers is becoming more broadly accessible, and, second and most important, the educational benefits resulting from the technology's use are gaining wider recognition through reports by instructors and students. In summary, more educators are using computer conferencing to deliver courses, manage them, and consult individually with students; more adult learners are enjoying the convenience of going to class online.

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Social and Intellectual Exchange Through Electronic Communications in a Graduate Community

*Barbara Grabowski**

The use of electronic communications is increasing in our society today. As the months go by, we are experiencing a proliferation of articles describing its use in a variety of settings. Just as one example, using the descriptor "electronic mail" on the ERIC online database yeilds 175 entries alone. Most of these articles describe technical aspects, suggestions for use, and procedures for implementing various electronic communication systems in both industry and higher education. Most industries use electronic mail mostly for sending memos and setting their calendars. However, what is very encouraging is the innovative and extensive use of electronic mail by Higher Education. Today, educational uses include teleresearching, professional

communication, electronic editorship, national and international cooperative research, national and international forums, accessing up-to-the minute professional news, and electronic publishing, (Seatta, 1986).

The purpose of most of the above stated uses of elecelectronic mail is to reduce problems caused by large geographic distances between colleagues.

However, some very important effects from local uses of electronic mail can also be realized. Kuehn (1988) suggests that electronic mail can extend classroom discussions, increase the ease of evaluating student assignments, increase the connectedness of students and faculty, and increase the social as well as an intellectual impact from this means of communication. Muffo (1987) also suggests that personal communications themselves can change due to the inclusion of computers, and particularly electronic mail in the curriculum, although Hellstein (1986) has noted a variety of patterns of use by different levels of users.

One of the problems we have observed at Syracuse University is the need to increase opportunities for intellectual and social exchange among our students. This includes new students who enter the program each semester who need to adjust to a new environment, establish new friends, adjust to a new pattern for studying, and juggle time for classes and life events, and seasoned students who are at the dissertation stage. They may be experiencing feelings of social and intellectual isolation and need outlets to exchange ideas, seek advice, and explore new avenues for thinking.

Besides trying to establish relationships with other students, we find that time interacting with faculty outside of the classroom is very critical to the intellectual and social development of the student. Unfortunately, like most universities, faculty time is very limited.

Finally, we also believe that it is very important to encourage our students to go beyond the walls of the university to establish a network of colleagues at various institutions. However, with the tightening of budgets, we do not have the same opportunities for bringing in experts to speak with our students.

Since it has been suggested that eletronic mail has the potential for increasing the "connectedness" of students and faculty, we have attempted to create an environment similar to Hiltz's (1986) virtual classroom where the "logical walls are extended way beyond the physical walls of the classroom" that would enable us to address the problems listed above. During the first semester, students are given a computer account with minimal training on the use of electronic mail. Throughout the year, opportunities are provided for the students to communicate with their advisor, professors, other students within the department, and other national and international scholars, practitioners and students. Information is disseminated on national and international electronic conferences, and at least one international electronic conference is organized and originated out of our department each semester.

Observations throughout the year indicated that there were several sub-populations of the larger group--those who were heavy users, light users, one-time users, and those who did not use it at all. In spite of the opportunities afforded the students, the use of this tool it appeared was, as yet, not widespread. In order to identify the level of use by the students and faculty and to evaluate the perceived usefulness of electronic mail use on the level of intellectual and social exchange and satisfaction within our program, we mailed surveys to 98 students who were currently enrolled. The principle findings can be summarized as follow:

Sixty-eight students returned the questionnaire completed, for a 69% return rate. Of those, 38 students were users, and 30 were non-users.

The purpose of the survey was to gain insights into four areas: who were likely users, why were they using email, what factors influenced its non-use, and what was their perception of the social and intellectual impact of it.

Who were the likely users or non-users?

From the survey data, full time doctoral students without children are the most likely email users in our graduate school community. After analyzing the demographic data of the users-only against the frequency of use, we found only one factor significant: full time students use email more frequently than part time students.

Why were they using email?

A high percentage of the users-only group send mail to fellow students, friends and faculty for the purpose of exchanging information, discussing of ideas and a fewer number, to exchange social information.

What factors influenced its non-use?

For non-users, "No Need" (40%) was reported most as the reason for non-use suprisingly, technical skill (13%) and convenience (14%) were not as important as we originally hypothesized.

What were the users'-only perception of the social

and intellectual impact of email?

From the data, there was very little indication of social impact, but a very high indication of intellectual impact among users, with 23% of the respondents either agreeing or strongly agreeing with the statement about social impact; whereas 73% agreed or strongly agreed with the statement about the impact on their intellectual life. Seventy-nine percent also agreed or strongly agreed that email was worth the effort; 63% felt it did not disrupt their life with information overload; and 68% felt that the notes were worth reading.

The most important information from this survey was the perception of electronic mail as a medium for intellectual rather than for social exchange. It will be very interesting to track the changes over time as electronic mail becomes just another part of the graduate school culture.

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Hypertext and its contribution to CMC

Alex Romiszowski *

"Collaborative creativity" is one of the tenets of the belief-structure of many Hypertext enthusiasts. Indeed, one particularly fruitful area of application for hypertext systems has turned out to be the collaborative authoring of literature (often fiction). The collaborative annotation of student papers by both faculty and students is also something that many proponents of hypertext advocate and (occasionally) practice. One of the more long-lived working hypertext environments - Intermedia at Brown University - was specifically designed to support this sort of collaborative educational activity.

However, current hypertext systems which can support this type of activity effectively are large, purpose built systems, which are costly and not easily compatible across different computer systems. Our current projects are based on the concept of utilizing, as much as is possible, what already exists and is established in significant quantity in the educational marketplace. At this point in time (in USA universities at any rate) the MS-DOS personal computer has the largest market share followed by the Macintosh. Also, many existing e-mail systems operate as networks of existing general purpose personal computers. When used for e-mail, these computers are called on to act simply as dumb terminals linked to the mainframe that supports the communications system. However, it is possible to make use of the presence of local power and memory storage to download incoming mail messages to be stored directly on disc. It should be possible to adapt an existing pc-based hypertext environment so that new messages can not only be stored in appropriate subdivisions of the basic structure one creates, but can also be freely cross referenced to other relevant messages. We are investigating the applicability of some currently available and relatively cheap hypertext applications packages for this purpose.

Computer mediated communication

A recent experiment involved the use of a networked communication space, set up in Hypercard and running on a Macintosh cluster. Each of the participants in the CMC seminar has a stack of pre-prepared cards, with scrolling text windows, thus giving unlimited writing space, but dividing the text into "chunks", so that each separate issue/topic in the discussion has its own card. These cards can be accessed by all the participants, who can read them, add small annotations and make links to cards in their own stack. As the discussion progresses, a cross-referenced network of documents is created. This facilitates the review of the discussion by a new participant or by someone who has not logged on for some time. It also ensures that new comments are linked to earlier ones on the same topic, as well as making it very easy to review all the contributions of any one participant.

We are currently using this networked system on campus, in an experiment which is a model for a system that could in future be accessed over telecommunication links from any distance. For the time being we are more concerned with investigating the value of such a structured communication system as compared to other alternatives and have not addressed the question of making it widely available. As the system is conceived as an alternative to e-mail or other readily available CMC systems, we are concentrating on the comparison of these alternatives from the user's viewpoint. During October/December 1989, we used several alternative structured communication systems including the system just described and a file-sharing system in which all participants comment on a position paper in the same file, but do so by inserting their comments among other related comments (somewhat like Philo's workshop). This can be implemented on existing mainframe systems, in our case in CMS.

So far, we have the results of a small pilot project, from which conclusive findings cannot be drawn. However, as a project to guide future work in the design of CMC seminar methods, it has served to at least suggest that we are on the right lines in some respects and maybe not so in others.

Firstly, it has confirmed our conviction that CMC can offer very real benefits in an instructional role, as well as its already well proven applications in a conversational/social role. It can augment both the quantity and the quality of participant interaction in a seminar-like situation, as compared to what is typically obtained in practice in face-to-face seminars. Furthermore, it can accomplish this in a distance-education system.

Secondly, it has confirmed our conviction that careful design of the seminar structure and appropriate initial guidance/feedback, can considerably reduce the burden of moderation, thus enabling one moderator to handle an economically large group of students.

Thirdly, it has confirmed our conviction that quite simple approaches to structuring the incoming messages offer considerable benefits over the chronologically sequenced stream of information that results when simple e-mail systems are used for instructional CMC.

Lastly, the hypertext approach requires further study to identify just how and where (or indeed whether) it may be beneficial as an aid to structural thinking and communication. At the time of writing, two further experiments are in operation, investigating specific aspects of the use of hypertext environments for instructional purposes. The results of this work will be discussed in the Hypertext/Hypermedia Workshop, to be held at Syracuse University on May 18 and 19.

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Further information on this research may be obtained by completing and returning the coupon on the last page of this journal.

Job-Aids

Alex Romiszowski

MAP#1 JOB-AIDS: THE CONCEPT

Introduction

The job-aids section of this journal will provide you with handy reference material that should be of permanent use to you when planning, preparing, delivering or evaluating instruction. In this first job-aids section, we define the concept of job-aids, analyze examples of several types of job-aids, discuss the uses of job-aids in instruction and provide you with some sample job-aids.

Job-Aids: Definition

Job-aids, or better, "job-performance-aids," are any form of reference material or tool, that are:

1. available and usable on-the-job, and
2. enhance the effectiveness and efficiency of the job performer, by
3. reducing the performer's reliance on previously learned skills or knowledge.

Note that our definition includes memory-enhancing materials (such as reference manuals) and thinking enhancing tools (e.g., pocket calculators), but excludes perception, strength or dexterity enhancing tools (e.g., stethoscopes, pliers, torque wrenches).

Uses of Job-Aids

The "bottom-line" reason for the use of job-aids is to improve the reliability of job-performance
1) by reducing the mental load of facts and procedures to be memorized, or
2) by reducing the level of skill (therefore, the amount of practice) required to achieve the expected job performance standards.

The "intermediate" results of using job-aids include:

1. the simplification of instruction, by eliminating much drill-and-practice of procedures that no longer need to be memorized, or in some cases—
2. the total elimination of the need for instruction in specific aspects of the job.

Value of Job-Aids

Many organizations that have incorporated the use of well-designed job-aids throughout their operations have achieved:

1. significant improvements in job-performance and the resultant productivity;
2. significant reductions in training time and costs (savings in excess of 50% have often been reported).

Example 1: Information Maps

The most commonly used form of job-aid is a reference manual. Unfortunately, the majority of manuals are very poorly designed and written. Consequently they do not improve performance or reduce the need for prior training. The INFORMATION MAPPING approach is a particularly powerful methodology for the design of reference manuals that really work as job-aids.

The manual is divided into units, called MAPS. Each map is designed for a specific purpose and is so organized that the reader can immediately identify relevant information and skip over any information not required at that moment.

The first few pages of this article are examples of information maps. However, to illustrate all the aspects of the methodology, several hundred maps (or a 2-day workshop we can organize) are necessary.

Checklist Example 2:

Checklists are useful to reduce one's reliance on memory and to ensure compliance with multi-step procedures.

A classic example of the use of checklists is in aircraft maintenance, where every mechanic must check off every step of the maintenance procedure performed, on a printed checklist, so as to eliminate the possibility of forgetting to do anything. This is an example of a checklist used as a MEMORY-AID.

Figure 3, at the end of this article, is an example of a checklist used as a DECISION-MAKING AID. Note that the user must still assess a series of factors in the situation (course) being analyzed, but the checklist:

1. ensures that all the relevant factors are considered (memory aid) and
2. prompts the user as to the weighting to give to each of the factors in the final decision, and why to give this weighting (decision-making aid).

Example 3: Flow-Charts or Algorithms

Flow-charts are graphical representations of a process or procedure.
They are particularly useful when the procedure involves several alternative sub-procedures.
Figures 1 and 2 are examples of flow-charts laid out in a binary (or yes/no) decision-making format. This format, borrowed from computer science, is called "algorithmic".
A characteristic of true algorithms is that they can be applied to solve any problem of the class for which they are designed.

Example 4: Decision Tables

An alternative way of presenting a job-aid for a complex decision-making task is in the form of a decision-table. Compare the use of this table , with the original prose version of the instructions (see Example 4 in MAP#3).

Choice of Ordering Method(In a stock Control System)

Condition	1	2	3	4	5
1. Is it class A?	Y	N	-	-	N
2. Usage <5p/a?	N	-	Y	N	N
3. Usage >200p/	-	Y	-	-	N
4. Is it class C?	-	N	-	Y	N
Actions:					
A: Schedule ordering	X	X			
B: Base stock control			X		
C: Stock control				X	X

Example 5: If-then Charts or Rule-Sets

The if-then chart is another way of representing a decision-making process. It is often less algorithmic in its nature than a decision-table.
Some of the rules may involve judgment, or the weighing up of probabilities, on the part of the user. Map 2 of this article is an example of an if-then chart.

Example 6: Expert Systems

An expert system is computer-based software that is designed to assist in complex decision-making. It embodies the expertise of outstanding decision-makers in the domain for which it is designed, usually in the form of a large number of rules that must be taken into consideration when arriving at a "best" decision. The checking-out of this long list of rules is done by the expert system much faster and more reliably then could be done by a human being, even if supported by a printed job-aid. This latter assertion is, of course, only true when the decision-making process is quite complex. The checklist in Figure 3 is in fact derived from the same logic as is embodied in a computer-based expert system (CBT Analyst-Park Row Software). In this case, the logic is simple enough to make the paper-based job-aid quite competitive.

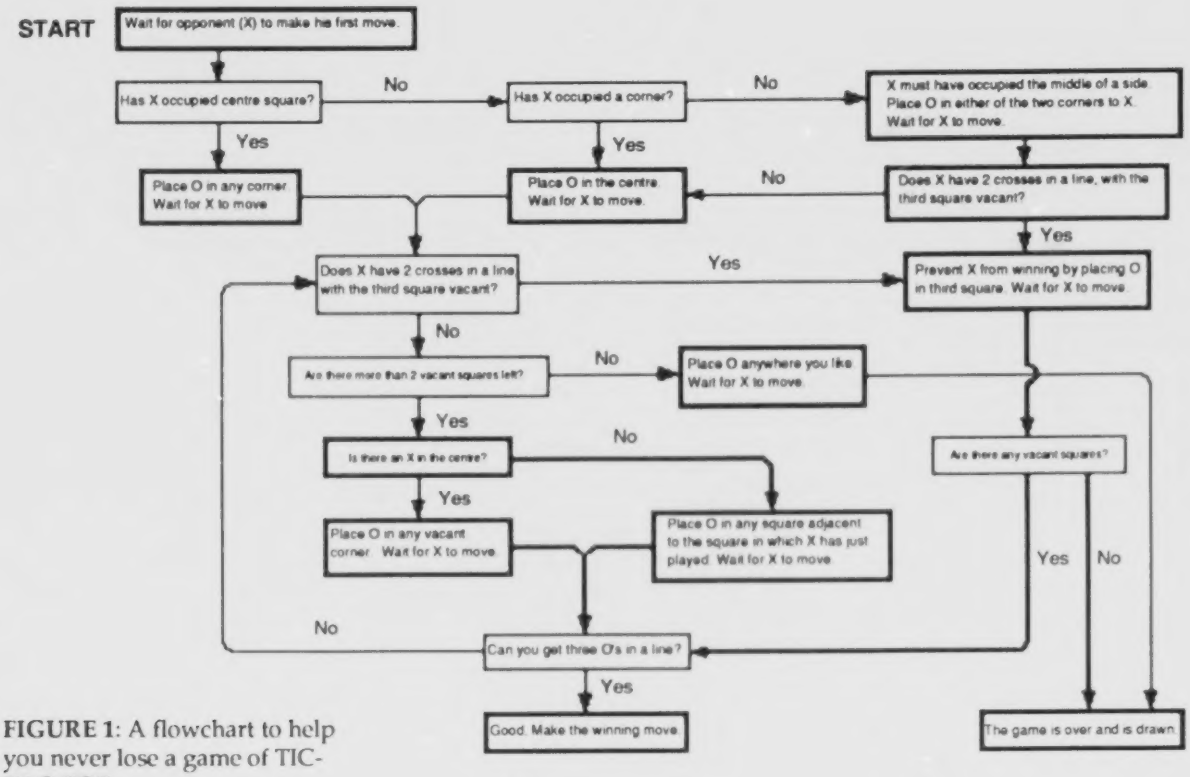
START
Wait for opponent (X) to make his first move.
Has X occupied centre square?
No
Has X occupied a corner?
No
X must have occupied the middle of a side. Place O in either of the two corners to X. Wait for X to move.
Yes
Yes
Place O in any corner. Wait for X to move
Place O in the centre. Wait for X to move.
No
Does X have 2 crosses in a line, with the third square vacant?
Yes
Does X have 2 crosses in a line with the third square vacant?
Yes
Prevent X from winning by placing O in third square. Wait for X to move.
No
Are there more than 2 vacant squares left?
No
Place O anywhere you like. Wait for X to move.
Yes
Is there an X in the centre?
No
Are there any vacant squares?
Yes
Place O in any vacant corner. Wait for X to move.
Place O in any square adjacent to the square in which X has just played. Wait for X to move.
Yes
No
No
Can you get three O's in a line?
Yes
Good. Make the winning move.
The game is over and is drawn.

FIGURE 1: A flowchart to help you never lose a game of TIC-TAC-TOE.

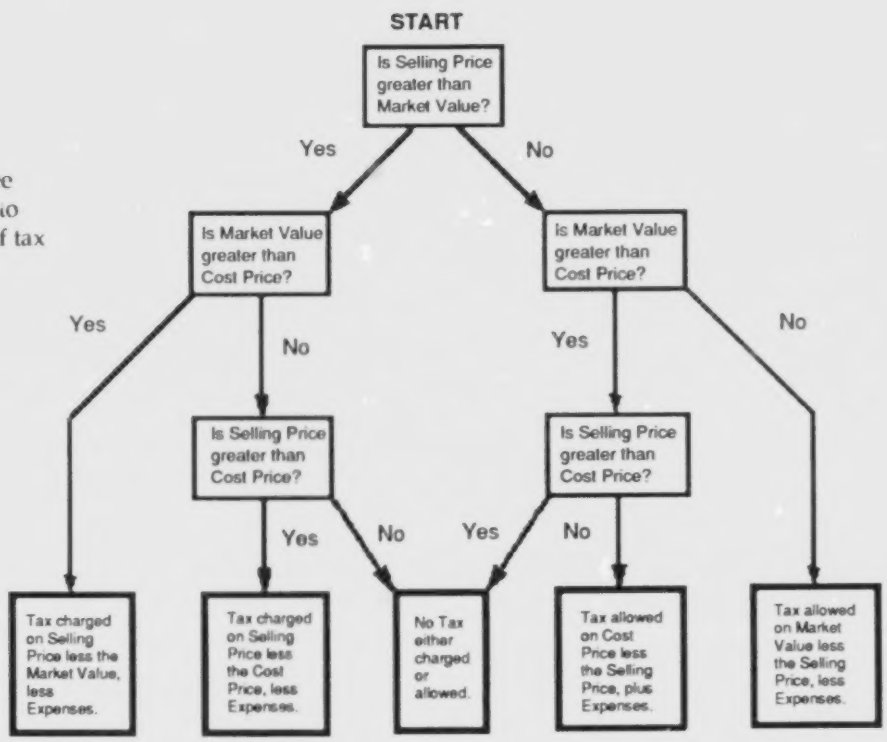
START
Is Selling Price greater than Market Value?
Yes
No
Is Market Value greater than Cost Price?
Is Market Value greater than Cost Price?
Yes
No
Yes
No
Is Selling Price greater than Cost Price?
Is Selling Price greater than Cost Price?
Yes
No
Yes
No
Tax charged on Selling Price less the Market Value, less Expenses.
Tax charged on Selling Price less the Cost Price, less Expenses.
No Tax either charged or allowed.
Tax allowed on Cost Price less the Selling Price, plus Expenses.
Tax allowed on Market Value less the Selling Price, less Expenses.

FIGURE 2: A decision tree from a flowchart job aid, to assist in the completion of tax returns (U.K. 1967).

Question	Response	Score	Explanation
1. Does this course currently exist in some form?	Yes No (go to question 4)	0	If a course exists in some form, CBT development time/cost will be reduced. Developing a new course in CBT form involves both curriculum and CBT development.
2. Is this course currently in self study format?	Yes No	+1 0	A self study course is more suitable for CBT because it has already been designed for individualized instruction.
3. How effective is the current course?	Very Effective Moderately Effective Somewhat Effective Not Effective	-1 0 0 +1	CBT is likely to improve the effectiveness of an existing course due to individualization, feedback and interactivity.
4. What is the projected lifetime of the course year?	Under 2 years 2-5 years Over 5 years	-1 +1 +5	The longer the projected course lifetime, the greater the payback for CBT.
5. What is the annual student enrollment?	Under 100/yr... ...and over 5 years ...but under 5 years 100-999/yr... ...and over 5 years ...but under 5 years Over 1000/yr	 +1 0 +2 +1 +5	The number of students affects the feasibility of CBT.
6. What is the estimated duration of the course in hours?	Less than 4 hrs. 4-8 hrs. 8-16 hrs. Over 16 hrs.	+1 0 0 +1	The course duration determines the suitability of CBT; extremely brief and long courses are more suitable for CBT.
7. How much of the course will be revised annually?	Less than 5% per yr. Between 5-25% per yr. Greater than 25% per yr.	+1 0 +1	The amount of revision affects the CBT feasibility. A very small or very large amount of revision favors CBT.
8. How important is on-the-job delivery of the training?	Very important Somewhat important Not important	+2 0 0	CBT makes highly effective on-the-job training possible.
9. Does this course depend upon hard to find instructors?	Yes No	+1 0	An important benefit of CBT is that it can compensate for unavailable instructors.

(Figure 3)

(continued next page)

Question	Response	Score	Explanation
10. Does this course involve hands-on activities with eqiupment or software?		+1 0	Simulations can be used to provide effective hands-on activities.
11. Does this course involve a lot of human interaction?	Yes No	-2 0	Courses that involve a high degree of human interaction are not well suited for CBT.
12. Does this course teach critical job skills of knowledge?	Yes No	+1 0	Because of the effectiveness of CBT, it is especially appropriate for critical courses.
13. Do the students in this course have a wide variation in background or experience?	Yes No	+1 0	CBT provides individualized instruction which is especially suited to wide student variety.
14. How important is standardization of training?	Very important Somewhat important Not important	+1 0 0	CBT can provide highly uniform training.
15. Is the student load in this course likely to fluctuate over time?	Yes No	+1 0	CBT can easily accomodate fluctuations in student loads.
16. How important is tracking of student progress	Very important Somewhat important Not important	+1 0 0	CBT makes it easy to track student progress/performance.

Total score _____

Conclusion:

Scores from -9 to 0	This course is not a candidate for CBT.
Scores from 1 to 10	This course is a possible candidate for CBT.
Scores from 11 to 20	This course is a good candidate for CBT.
Scores from 21 to 30	This course is an excellent candidate for CBT.

MAP #2 DECIDING WHEN TO USE JOB-AIDS (AND WHAT TYPE)

Introduction *As with the design of instruction, the design of job-aids should commence with an analysis of the specific task or tasks that are to be performed on the job. The following rule-set is a simplified representation of the decision-making process that is involved in this analysis.*

If-Then Chart

IF...	THEN...
1. The task can be but cut altogether,or fully automated, with reasonable effort/expense.	Do not consider either job-aids or instruction. Go for more permanent " Job Redesign" solutions.
2. The task is so simple, or can be simplified, so that no explanation or help is required to perform correctly.	Job-aids are not necessary. Simply performing the task is enough to develop the necessary skills.
3. A set of simple, non-technical instructions are sufficient to ensure adquate performance.	Consider a simple checklist of dos and don'ts as a memory aid.
4. Technical terminology, concepts and explanations, or the application of general principles, are required to ensure adequate performance.	Some instruction will be necessary to teach the basics. Then a job-aid may be used to aid memory.
5. The task is basically linear, or with few branches leading to only a few (two or three) alternative outcomes.	A simple checklist or well-designed prose statement should be adequate as job-aids.
6. The task involves the application of a few decision rules, over and over again, in a cyclic or "iterative" set of "loops".	An algorithmic flow-chart representation of the procedure is an effective and economical way of presenting a job-aid (see Figure 1).
7. The task involves the application of a number of rules in combination in order to arrive at a correct decision.	A "decision tree" flow-chart, or a decision table are effective and economical ways of presenting a job-aid (see Figure 2).
8. The task involves the application of a few, relatively independent rules, which involve the weighting of a decision either in favor or against a certain outcome or action.	A "weighted checklist" or questionnaire may be used. The answering of the questions is followed by the computation of the final weighting (see figure 3).
9. The task involves the application of a number of complex rules that involve judgement, may be interrelated, and are based on experience of similar cases .	Prior instruction in the basics and some organized practice opportunities are required. Job-aids may be unnecessary but are useful as memory aids. This map (Map #2) is a typical example.
10. The task is complex, involving a combination of the conditions outlined above in rules 6,7,8 and 9, and human experts are available to be interviewed/observed exhaustively.	Computer-based "expert systems" are indicated as the most appropriate form of job-aid, on the grounds of both complexity of the expertise involved, and the ease of use of the job-aid.
11. The job conditions or context do not allow reference to job-aids (e.g., poor light, literacy, time pressure, visual load of task, loss of face).	Reconsider the technical reasons for using a job-aid, in the light of the practical usage factors that you have identified.
12. The conditions or context of the job make it relatively expensive to develop or use job-aids (few persons involved, frequency of task, its importance, cost of experts).	Reconsider the technical reasons for using a job-aid in the light of these economic factors of job-aid development and use.

MAP #3 ANALYSIS OF SOME ASPECTS OF JOB-AIDS

Introduction

Space here is too limited to give a full set of guidelines to the design, development and use of job-aids. We present just a few problem examples, which illustrate some aspects of the topic.

Example 1: When does it make sense to use job-aids

Study the algorithm for TIC-TAC-TOE, presented in Figure 1. Using this as a job-aid guarantees that you will never lose a game (unless of course you made an error in following the algorithm).

However, your opponent would consider that you have an unfair advantage. So you give a copy to the opponent. Now, if you both use the job-aid correctly, all games will end in a draw. Is there any point left in the game?
A more appropriate use of such a flow-chart might be as an instructional aid, in the training of your TIC-TAC-TOE team, so that your players internalize the algorithm. Your team then has an advantage, which would not be considered unfair.

Example 2: The power of well designed job-aids

Study the decision tree presented in Figure 2. This is part of a manual developed in 1967, all in flow-chart form, to help British taxpayers to prepare their income tax returns. This is a classic application for job-aids, in preference to instruction. How frequently do you perform the task of completing your income tax return? How stable is the information? Does it make sense for anyone to learn this? Since 1967, in Britain, efficient job-aids have been developed and distributed, to help the public do such tasks correctly and fast.

Compare the job-aid in Figure 2 with the original prose leaflet. Part of this leaflet read as follows.

> "(i) If the asset consists of stocks or shares which have values quoted on a stock exchange (see also paragraph G below), or unit trust units whose values are regularly quoted, the gain or loss (subject to expenses) accruing after 6 April 1965, is the difference between the amount you received on disposal and the market value on 6 April 1965, except that in the case of a gain where the actual cost of the asset was higher than the value at 6 April 1965, the chargeable gain is the excess of the amount you received on disposal over the original cost or acquisition price; and in the case of a loss, where the actual cost of the asset was lower than the value at 6 April 1985, the allowable loss is the excess of the original cost or acquisition price over the amount received or. disposal.
> If the substitution of original cost for the value at 6 April 1965, turns a gain into a loss, or a loss into a gain, there is, for the purposes of tax, no chargeable gain or allowable loss."

Here are a couple of typical cases for you to solve. Attempt case 1 by reference to the leaflet above. Then attempt case 2 by reference to Figure 2. Compare your success and the time and effort it cost you.

> **Case 1** Mr. Jones bought some shares in 1964 for $2,000
> On 6 April 1965 their market value was $2,500
> Later in 1965 he sold these shares for $2,300
> His expenses came to $50
> **Problem**: What is Mr Jones's Tax Liability?

> **Case 2** Mr. Smith bought some shares in 1964 for $75
> On 6 April 1965 their market value was $85
> Later in 1965 he sold these shares for $65
> His expenses came to $5
> **Problem**: What is Mr Smith's tax position?

Example 3: When should the job-aid be computer-based

Study the "weighted checklist" presented in Figure 3. This was developed by one of the School of Education's students (Hsi Hsien Chang, IDD&E) by analyzing the decision-making logic built into a commercially available "expert system" that is designed to assist the user in deciding whether, and how to use, Computer-Based-Training (CBT) in a given course (The CBT Analyst, Park Row Software, 1986). Figure 3 is equivalent to one of the five sections of the computer-based job-aid (Selecting Courses for CBT). The software itself is based on some of the chapters of the book "Computer Based Training" (G. Kearsley, Addison-Wesley, 1984).

In comparative tests, we have shown that using the paper-based version is, in this case, as fast and as accurate as using the computer-based version. However, as the complexity of the decision-making process increases, there is a growing advantage, both in speed and accuracy, for computer-based versions.

Example 4: When to use decision table

Study the decision table, presented in Map #1 as part of Example 4. By itself, this table may be meaningless. It needs a sentence or two to establish the context of the task. The first two sentences of the prose "instructions" which follow, establish this context. The rest is a prose version of the instructions, from which the decision table in Map #1 was developed. Can you see how the table was developed from the prose? Are you certain that the decision table is correct?

THE CHOICE OF ORDERING METHOD

In order to reduce the capital tie-up in stocks, and also to improve the reliability of supply, it has been decided to introduce new rules for the choice of ordering method, for different classes of stock. Whether to stock an item or not, will still be regulated by SPI No 178.
The rules for the choice of ordering method for stocked items, will in future, be as follows:

1) Schedule ordering	based on the best possible forecast of future requirements - Will be used in future for all Class A (Pareto Analysis) items, for which the annual usage is more than 4 per year, and for Class B items with an annual usage of over 200 per year.
2) Base Stock Control	will be used for Class A and B items with an annual usage of less than 5 parts per year and for Class C items with the same provision requirement.
3) Stock Control	based on our previously universal method of fixed re-order levels - will only be used for Class C items with a usage of more than 4 per year.

In fact, the table was developed by following 5 stages of design and simplification, which ensure that the table is not only correct, but is the simplest possible presentation of the task. If you would like a detailed set of instructions on the design and development of such decision tables, please write to us.

Problems for your consideration:
1) Presentation of job-aids

Look again at the flow-charts presented in Figures 1and 2. Now that we know the structure of the task in each of these cases, consider whether the flow-chart is the most convenient and effective way of presenting the information to the user . Try to redesign these two job aids. Can you think of some even clearer and simpler ways of constructing the job-aids? Send us your solutions. We will publish the best ones received.

2) Computer storage

Consider all the examples presented in this article, together with other examples of job-aids that you might know. When does it make sense, in your opinion, to use a computer as a job-aid delivery tool and when does it make more sense to use printed material? Try to formulate your own IF-THEN table of rules that would help you decide which way to go. We will analyse all the tables received and publish a synthesis of your ideas, as a job-

THE TRAINING SYSTEMS INSTITUTE: RECENT PROJECTS

The Training Systems Institute (TSI) is affiliated with the Area of Instructional Design, Development and Evaluation.

TSI provides services in all aspects of educational design, development, and evaluation to business, industry, government, allied health, human services, and education. Projects may involve training needs assessment, design, development, and delivery of training programs, development of instructional materials, evaluation studies, planning for new technologies, organization development, and the development of human resources specialists.

Projects are executed in three ways:

1. TSI executes all project activities under contract to the client organization.
2. TSI acts as a knowledge and technology consultant, working in partnership with the client's staff.
3. TSI places a graduate student intern in the client organization, sharing supervision of the intern with the client.

Recent projects in the first category have included:
- the development of computer-based instruction and interactive video scripts for the internal training needs of a financial institution;
- the design, development and delivery of a job-related training system, for human resource development specialists—this training is delivered largely by distance education, throughout New York State.

In the second category, we have recently:
- worked with a utilities company to assist their in-house personnel in the design and development of an interactive-video-disc on the topic of safety procedures in nuclear power plants;
- worked with a simulator-design company on the training of military personnel in the skills of courseware authoring—it was necessary to teach pedagogically sound design methodology, as well as the skills of utilization of the specific courseware authoring system that had been installed.

The third category, internships, is very flexible. For example:
- we regularly place instructional design, development and evaluation graduate students in full-time internships, for a period of 2 to 4 months—regular client-companies include McDonnell Douglas, Kodak, Motorola, Arthur Andersen, Apple Computer and many others.
- we also place students on a part-time basis, one or two days per week typically, in local companies. This allows just the correct intensity of work on a given project while guaranteeing closer supervision of progress by Syracuse University faculty. Recent part-time internees have developed: safety training for Buckbee Mears, Cortland; supervisory training for the Carrier Corporation; teacher-education materials for WCNY; computer-based instruction for management development at the MONY Corporation; health-related training for the Red Cross, Blue Cross and local Syracuse hospitals.

Further information may be obtained by completing and returning both sides of the coupon below.

To evaluate the materials in this journal edition and/or to request additional information, please complete and return the coupon below and mail to:

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Please evaluate the sections in this issue on a scale from 1 (low) to 5 (high) in terms of their value/interest to you.

Feature articles _____ Developments and innovations _____

Research reviews _____ Job-Aids _____

Comments:

What other sections/themes would you like to see addressed in future issues?

(over)

INDONESIA SEEKS THE UPGRADING OF HIGHER EDUCATION

In 1985 the Government of Indonesia embarked on an ambitious program for upgrading the quality of higher education in the country. A loan agreement with the World Bank permitted the establishing of 16 Inter-University Centers. These centers which have become operational since 1987 are established to coordinate their scarce resources for the purposes of: 1) improving the quality of graduate study programs in various fields of study and to increase its output; 2) increasing the number of qualified and trained academic staff; 3) stimulating research and development activities in specific fields; and 4) dissemination of information on new concepts, methodologies and applications arising from research in Indonesia or elsewhere.

The responsibility and the function of 15 of these centers focuses on self-improvement and development in a specific discipline or a field of inquiry (Life Science, Engineering Science, Bio-Sciences, Social Studies and Economic Studies). The 16th center, the Inter-University Center for Improvement and Development of Instructional Activities (IUC-IDIA), on the other hand, is involved with the upgrading of instructional capabilities across all the disciplines and fields of study.

IUC-IDIA has been mandated to assist in improving the higher education instructional environment by attempting to redesign and develop instructional materials, strategies, methods, and techniques; by assisting in the development of learning resource centers; and through enhancing the development of educational technology as a field of study and as a profession.

The IUC-IDIA task is formidable and odds are not in favor of change. The innovational objectives of IUC-IDIA are subject to all of the usual constraints and resistance that the status quo can muster. Notwithstanding, IUC-IDIA has set forth considerable effort toward the attainment of its objectives by initiating and/or supporting staff/faculty development and by developing large quantities of instructional materials.

In improving the educational resources, human and otherwise, IUC-IDIA has enlisted the assistance of other institutions in conducting workshops, short courses, conferences, seminars, internship and degree programs in Indonesia and abroad. Syracuse University has lent its support to these efforts by participating in IUC-IDIA initiated activities in US and in Indonesia and by hosting a number of students seeking masters and doctoral degrees in the Division of Educational Development, Counseling and Administrative Studies (EDCAS).

EDCAS, as part of its International R & D activities, has also been involved in designing and implementing nine individualized educational programs for about forty IUC-IDIA sponsored interns. Some of these programs have been designed for participation by only one intern. Others have involved as many as twelve individuals who participated in the projects from various disciplines and fields of study such as medicine, dentistry, mathematics, animal husbandry, literature, education, economics, fishery, food and nutrition, mechanical engineering, etc.

The general topics of the internship projects include information science; management of media production; curriculum development; management of distance education; textbook writing; instructional design, development and evaluation; human resource development; and project management.

In the process of the development and implementation of various components of each project, EDCAS has been successful in enlisting and receiving full campus-wide support as well as that of various departments in about 15 universities and from a number of commercial agencies throughout the country.

☐ I am interested in obtaining further information on:

- ☐ CMC: Philo's Workshop (Green)
- ☐ CMC: Computer Conferencing (Florini)
- ☐ CMC: Social and Intellectual Exchange Through Electronic Communication in a Graduate Community (Grabowski)
- ☐ CMC: Hypertext and its Contribution to CMC (Romiszowski)
- ☐ CMC: Job-Aids
- ☐ Center for Instructional Development (CID)
- ☐ International R&D Activities
- ☐ Research Lab for Interactive Learning
- ☐ Summer Institute
- ☐ Training Systems Institute (TSI)
- ☐ Other

☐ I wish to receive a copy(ies) of the following working paper(s). See page 14 for the list of titles and costs. Please include payment with your order.

Number	Title	Quantity

SUMMER INSTITUTE FOR TRAINING TECHNOLOGY APPLICATIONS

These two-day workshops will present innovations which are on the cutting edge of technology applications and education.

SESSION 1: MAY 18-19

Hypertext/Hypermedia
Instructor: *Alexander Romiszowski,* Syracuse University
Hypermedia can be thought of as an integration of all available information on a topic, in whatever media into one network of interrelated and cross-referenced documents, which may accessed by the user in an infinite variety of ways.
Two important questions will be addressed concerning this technology:
•What specific applications of Hypertext/Hypermedia "make sense" in education and training?
•Do we have a powerful new solution to real and important problems, or merely an invention looking for an application?
Much of the work will be through analyzing existing examples of Hyper-documents and originating a document.
Effective International Consulting
Instructor: *David Giltrow,* Communications Consultants Cooperative International
International consulting in instructional communication and technology is increasing as countries appreciate the roles which communication, training and instructional development play in their overall educational plans. Effective international consulting requires certain skills, practical knowledge, and especially attitudes which are not always obvious when working in familiar domestic settings. This workshop covers some of these essential international consulting tools and provides participants the opportunity to share questions and experiences with other professionals hoping to broaden the scope of their consulting work.

SESSION 2: JUNE 1-2

Computer-Based Interactive Video: Design and Evaluation
Instructor: *Karen Lee Jost,* Syracuse University
When designing or evaluating computer-based interactive video, many factors should be considered. It is also important to focus on how these factors may interact and effect learner comprehension of the presentation.
This workshop will explore the following factors and how they influence the effectiveness of CBIV: learner variables; content; instructional design; message design; computer attributes; video attributes; and environmental considerations.
Instructional Designs for Individual Differences
Instructor: *David Jonassen,* University of Colorado at Denver
This workshop will examine the range of individual differences including: aptitudes; cognitive styles; learning styles; and personality variables. It will also examine how individual differences interact with instructional treatments and how to adapt instruction to accommodate individual differences. Students will assess their personal learning styles, including aptitude (structure of the intellect), cognitive styles (field articulation, conceptual style, leveling-sharpening), learning styles and personality (locus of control, intraversion) and others.

SESSION 3: JUNE 29-30

The Integrative Learning System: Implications for Corporate Change Through Training Redesign In Business, Schools, and Government Agencies
Instructor: *Laurence Martel,* Syracuse University
This workshop will include hands-on development of techniques which have been successfully demonstrated in both international corporations and school districts. The presentation will include: accelerated learning, learning styles, guided imagery, and cooperative learning. Case studies will include government sponsored programs in adult occupational and vocational training. In addition, this workshop will show how learning companies are created.
Hypercard: Designing and Authoring Innovative Instruction
Instructor: *Kyle Peck,* The Pennsylvania State University
This workshop teaches designers of CAI to use hypercard to produce innovative instruction employing text, graphics, sound resources and animation. Participants will learn to use Hypertalk scripting to gather data on student and lesson performance, and how to transport this data to spreadsheet and statistical packages for analysis. Instructional software developed in Hypercard by Penn State students and several "tricks" learned during the process will be shared.

Further information on the Summer Institute Sessions may be obtained by completing and returning the coupon.

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A Journal of the School of Education at Syracuse University
Summer 1990 Volume 1, Number 2

Readers' Column

Feature Articles

Some Thoughts On Improving Instruction — *Rob Branch*

Course-Level Academic Processes as Indicators of the Quality of Undergraduate College Education — *John Braxton*

Research Reviews

Structural Communication: A Forgotten Application of Cognitive Theory of Instruction — *Wende Pusch, Elisa Slee*

Developments and Innovations

Interpersonal Skills: Critical Attributes for Instructional Developers — *Ruth Curtis, Darlene Nestor*

Planning for Success: College Distance Education Programs — *Lynda Hanrahan*

Job-Aids — *Alex Romiszowski*

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Instructional Developments

Volume 1 *Number 2*

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As this second edition of INSTRUCTIONAL DEVELOPMENTS is being sent to the printer it is gratifying to note that your letters, telephone calls and personal comments show that the first issue of the journal has been well received. We are delighted, encouraged and appreciate the attention. We have also had some queries about the journal, necessitating some explanation. The journal is produced and edited in the Division of Educational Development, Counseling and Administrative Studies (EDCAS) in the School of Education at Syracuse University. EDCAS is comprised of five graduate programs: Adult Education, Counselor Education, Educational Administration, Higher Education and Instructional Design, Development and Evaluation.

The intended audience includes educators and trainers working in both public and private organizations locally, nationally and internationally. The journal is circulated to a mailing list of individuals concerned with various aspects of instruction - its design, development, management and delivery as well as evaluation and basic research. If you would like to be on our mailing list, please provide us with your name and address.

Although the bulk of the journal is written by Syracuse University faculty, graduate students and alumni, we hope to include invited contributions. We also encourage correspondence, and will publish significant, but short contributions to the debate on any subjects dealt with in the journal.

In the second issue of the journal we have added another section - the *readers' column* to accomodate dialogue. In this issue Arthur Blumberg's rejoinder to John Centra's article "Is There a Scientific Basis for Effective Teaching?" and John's reply, are published. We hope that this forum will be more extensively used in the future.

The *feature articles* section presents an essay by Rob Branch on why the task of improving instruction and instructional media is complex. He argues that improving instruction occurs when three complex entities of content, learner and teacher are actively involved. This essay is followed by John Braxton's article where the level of understanding of course content required by students in course-level academic processes is advanced as an approach to the definition of quality in undergraduate education.

In the *research reviews* section, Wende Pusch and Elisa Slee have set forth a discussion on and an examination of the key points of cognitive psychology, and how it relates to learning. They have presented structural communication as methodology which utilizes principles of cognitive psychology in promoting the learner's construction of knowledge, helping the learner to organize information and enhancing the learner's understanding. Pusch and Slee have provided a review of literature and research on structural communication and have proposed further research.

In an attempt to provide training in interpersonal skill-building for instructional designers and developers the Instructional Design, Development and Evaluation program at Syracuse University decided to pilot a course. The main goal of the course was for students to gain competence and confidence in their ability to interact with SME's, clients and colleagues. Ruth Curtis and Darlene Nestor in the *developments and innovations* section, provide information about and insight into the content and activities of this course and personal reactions of the students who participated. This article is followed by a paper presented by Lynda Hanrahan on the development and diffusion of a distance education program in engineering education at University College within Syracuse University. Everett Rogers' diffusion of innovations model sets the theoretical framework of this paper.

The *job-aids* section by Alex Romiszowski deals with the structural communication in its applied form. It includes problems, and allows for your response to stimulate involvement and dialogue. This is the first of a two-part article, and the second part is scheduled to appear in the next issue.

We invite you to initiate dialogue with us. Most authors are interested to hear your reactions and are willing to provide further information about their work. Again, thank you for your encouraging response to the first issue.

-- Firouz Rahmanzadeh

Readers' Column

A Brief Rejoinder to Centra's "Is There a Scientific Basis for Effective Teaching?"

Arthur Blumberg

I suspect that a measure of a journal's vibrancy can be found in the degree to which it provokes controversy and reaction among its readers. Thus, from my biased point-of-view, INSTRUCTIONAL DEVELOPMENTS, in its first issue, portends the possibility of long term vibrancy. At least, that's the way I see it as I react to Centra's (1990) "Is There a Scientific Basis for Effective Teaching?" published in vol.1, no.1.

My critique is specifically focused on the section of the article that is headed, "The Scientific Basis for Teaching" (pp. 7-8). Centra used Gage (1978) as the basis for his thesis. He notes that Gage argued "that there is a scientific basis to the art of teaching" (Centra, p. 7). This argument does not hold water.

First, let me say that, if I were Gage and I had spent my career defining and then studying teaching as a science I would most certainly maintain that there is a science of teaching. And I would want to brush off as statistical outliers the fact that there have been and continue to be wonderfully excellent teachers who know nothing about Gage's "science." If there is a science of something - though it doesn't have to be an exact science which probably doesn't exist, but one that is at least bonafide then it is reasonable to assume that one cannot use that science in an applied way unless one knows that science. The space shuttle, for example, could not have been engineered, built, flown and landed unless its variety of engineers knew and understood the implications that research in physics, electronics, astronomy, metallurgy, meteorology, to name only a few of the sciences that the newspaper-reading layperson must infer played a part in the success of the shuttle's design and flight.

There is no comparable argument as I noted above, which can be made for the practice of the craft (not art as Gage suggests) of teaching. That is, if we insist that there is a scientific basis for effective teaching, how can we account for the thousands of wonderful teachers that lived and taught before educational psychologists (for the most part, I beleive) started to try and emulate the "hard" sciences? Further, how can we account for the thousands of excellent teachers today who could not cite a piece of educational research as a rationale for what they do exceedingly well? Or how can we account for the millions of parents who do an outstanding job of teaching their children to be virtuous human beings?

The point I want to make is that teaching is neither a science nor an art, but a craft that at times, and quite unpredictably, can have moments of artistry attached to it when a teacher does something creative, graceful and beautiful in the classroom. All this is not to deny that a teacher could not learn something useful from studying the research on classroom group dynamics or child or adolescent development. It is to deny, though, that studying the research in these fields is prerequisite for being an effective teacher.

Finally, if my position corresponds with reality one must take the congruent position that research that is done to establish "a scientific basis for the art of teaching," though perhaps conducted in the best of faith, really serves the purpose of furthering the careers of the professors who conduct it, and has little to do with "everyteacher's" practice of teaching.

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Reply to Blumberg

John Centra

Art Blumberg is a crafty fellow. He argues that there is absolutely no scientific basis to teaching because there were "thousands of wonderful teachers" before educational researchers carried on experiments or observations of teaching. Although Arthur is about to retire, I doubt that he has been around long enough to witness personally all of those wonderful teachers.

Admittedly wonderful teachers existed centuries ago, just as there have been wonderful people who build bridges and helped to cure illnesses. And all of these individuals practiced long before a scientific basis of engineering, medicine, or teaching existed in any formal sense. But my point is that we do all of these things better because of the systematic studies, both basic and applied, that have gone on and continue going on. In that sense, science has enhanced the artistry (or craft) that is part of good teaching.

Some Thoughts On Improving Instruction

*Rob Branch**

In this age characterized by rapid technological advances, many of society's stakeholders are concerned about our citizens being denied a quality education. National test scores are having a less than positive impact on the preparation of our children as future teachers, doctors, lawyers, engineers, political leaders, and other professionals. America's State governors have been convened by our President to resolve the nation's educational problems. Our colleges and universities are independently forming consortiums among themselves, and with business and industry to provide the answers to 'why Johnny can't read.' Accountability is being translated into merit pay for educators at each level of the formal education echelon. These, and other such efforts are commendable, indeed laudable, but education in the United States will succeed when instruction in the classroom is improved.

This is an essay about why the task of improving instruction and instructional media is complex. This is also a commentary on the profile of those who would assume the leadership for undertaking such complex tasks. Improving or designing instruction and instructional media occurs in an environment where the three entities involved are in and of themselves complex in composition: Content, the Learner, and the Teacher (Figure 1). The interaction of these three entities in the instructional environment cause the complexity of designing or improving any instruction or instructional media to increase exponentially as the attributes of each entity are factored into the process. Therefore, parents, teachers, legislators, instructional designers, media specialists and all the stakeholders in our society must consider each of the three entities of the instructional environment singly, and must also regard the process which occurs during the content-learner-teacher (CLT) interactions as representing physical and psychological applications of the concept — the whole is greater than the sum of its parts.

Content, Learner, and Teacher: Three Complex Entities

The information that represents a domain of knowledge, or any subject matter information, is complex due to the base of knowledge it represents and the decisions

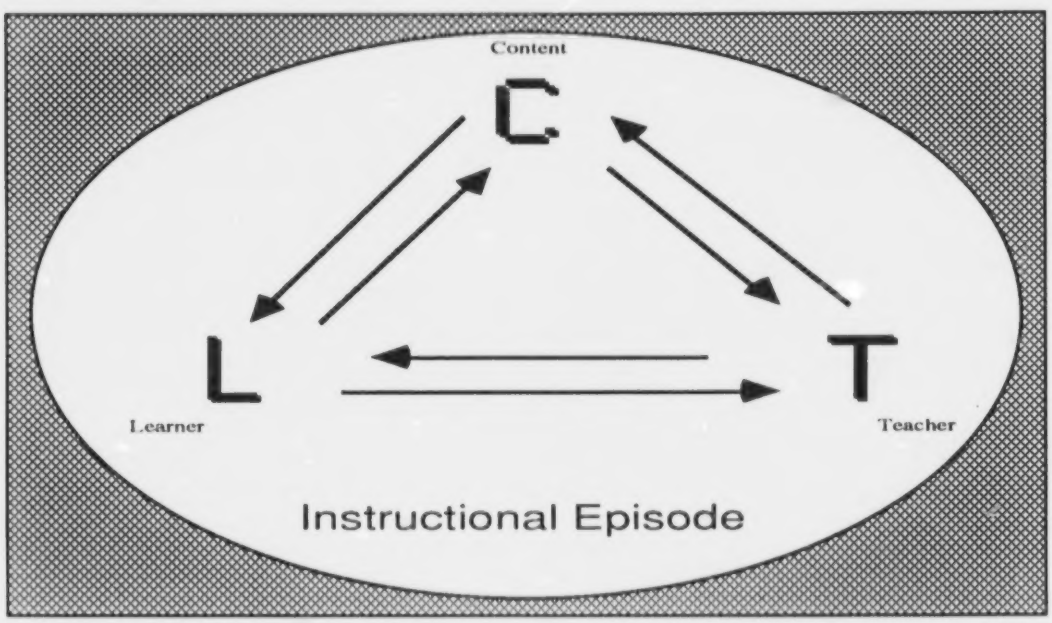

Figure 1. Illustration of the interactions during the instructional episode.

regarding how such knowledge, and its attributes, are transmitted or perceived. The organization of any knowledge base is perceived differently from individual to individual, however, the knowledge base may appear to remain constant because of the taxonomy on which it is structured. The presentation of content is yet another issue that adds to the complexity of the instructional situation. The type of information, the amount of information, and the inherent delimitations of the manner in which subject matter information can be transmitted within the instructional environment, requires an approach that can accommodate and facilitate the meaningful organization of the complex nature of any subject matter information or content domain.

Learning theorists have clearly established that humans process information differently from one another and within themselves depending on the prevailing conditions. Learners process information differently from one time to the next, and also when there is a shift in the content domain. Individuals process information differently as their emotional state shifts, and as their information-processing style and ability changes. In addition to the variable of information-processing skills, the characteristics of an individual learner often become a variable that educators are unable to manipulate within the instructional environment. These and other such individual differences among learners and groupings of learners mark the learner entity as a complex one indeed.

The teacher, or, what might be more aptly described as the teacher function, is a complex entity because of the many roles the teacher assumes in the instructional environment. Of the many functions the teacher (or teacher function; or instructor) performs within the instructional environment, such as an information source, organizer, guide, tutor, director, remediator, and the promoter of meta-cognitive monitoring strategies, it is the facilitator that is the most important. Whomever (or whatever) assumes the teacher function must be able to analyze, design, develop, implement, manage, evaluate and revise instruction on an ongoing basis. Teacher functions must occur in an environment where success is measured in terms of achieving predetermined learner outcomes. The skills necessary for planning and proficiently performing such functions are not simple, nor are they easily acquired.

Leadership Profile

Each of the stakeholders mentioned above, and others, will need to assume an active posture in the instructional improvement process. However, the question of who will assume the leadership role in the way we design and improve instruction and instructional media within the framework of the CLT paradigm, may best be answered by analyzing the tasks involved in such an effort. Instructional design professionals who possess the competencies to prescribe strategies and tactics for the systematic design and improvement of instruction and instructional media are best suited to fit this role. However, the classroom practitioners who incorporates systematic instructional design applications into their teacher planning routines are also well suited to assume the leadership in the instructional improvement process. Practitioners on the front lines are most able to accurately assess the environment in which learning must occur. Teachers select appropriate information and prescribe methods necessary to achieve the educational goals of our society, and they are expected to perform the instruction which results in manifestations of that which we, as a society, aim to be.

The contention is that there is a high correlation between teacher planning routines and what instructional designers do when designing instruction. Instructional designers select, adapt, develop and refine a wide variety of instructional products (Martin, 1984). According to Kerr (1981): "Teachers are and are not instructional designers. Most teachers have not had formal training in the procedures commonly used by instructional designers: many find it difficult to shift their thinking into instructional design (ID) patterns when they are asked to do so as part of a course or workshop" (p. 364). In fact, teachers often express a negative attitude toward the use of instructional design models out of a fear that the systems approach will restrict creativity. A systems approach promotes creativity.

Successful teachers are designers of instruction, although they may not perceive themselves as such. Instructional designers systematically design, develop, implement, and evaluate instruction based on proven learning and cognitive theories (Gagne, Briggs & Wager, 1988). Systematically designed instruction is a process which allows the teacher to focus on learner outcomes and to establish clear relationships between instructional strategies and the predetermined learner outcomes. Instructional design is empirical and replicable (Dick and Carey, 1990). It is empirical because it is based on the results of experiment and observation rather than mathematical or scientific reasoning. It is replicable because the strategies for designing instruction are incorporated into the teaching environment in a highly structured and reiterative fashion. The systems approach has been proven successful in addressing the design of instruction and instructional improvement efforts because of the way in which a systems approach takes into account the respective attributes of the complex entities involved in the instructional episode.

Education and Instruction

The systems approach to improving instruction is valid only when a clear understanding of certain relationships, relative to education and instruction, and the domains that feature in any instructional improvement process, are clearly understood. To understand education is to first understand the nature of society. A group of people with common social, political and economic backgrounds constitute a society. In addition, societies have in common types of dress, music, food, religion, and language. Education is the process by which individuals acquire the knowledge about the customs of a society and are able to practice the mores of that society. The aims of a society, such as health, wealth and security, are self-determinant. Individuals collectively determine societal aims. Education *is* the means to prepare a citizenry to serve as active decision-makers when determining societal aims.

Current educational reform proposals are dominated by various perspectives of inquiry. The most common channels of inquiry are offered from the perspectives of administration, assessment, counseling, and curriculum. Each perspective addresses a different domain in the educational context. Administration involves the management of instruction. Assessment is concerned with ways of understanding and improving the efficacy of instruction. Counseling increases the awareness of different learner needs and personal problems that might interfere with the acquisition of knowledge in the instructional environment. A curriculum is a fixed course of study established by educational professionals among the society in order to achieve its educational aims. Instruction is subsumed as part of the curriculum.

Instruction, as subsumed under the concept of curriculum, is the intervention that occurs during a content-learner-teacher interaction where the expressed goal is to facilitate the movement of the learner from point A to point B along the educational continuum. A correct assessment of learner characteristics, an accurate analysis of content attributes, and the potential of the teacher to facilitate the learning process, are the independent variables within the instructional environment that the designer attempts to manipulate in order to create or improve any instruction. This interaction period is referred to as the instructional episode (see Figure 1).
Instruction is the process of influencing a learner in a desired direction. Process is a favorite term among educators and is used to describe some kind of definable sequence of actions or activities. In the context of instructional improvements the process allows instructional designers to review and prescribe logic patterns that depict how we influence individuals to learn. An emphasis is placed on that part of the definition of instruction that assumes the learner is the object of instruction. Emphasis is also placed on the assumption that instruction is goal oriented and for a specific purpose, thus, the control over what we achieve is implied. Hence, these factors are within the realm of our manipulation. For example, we can arrange the content information around an organizing idea; determine the usefulness of available resources; and make judgements about the people involved. Taking these variables into account, and subsequent sequencing of intervention activities (tactics) promotes the potential for success of the instructional episode given the interactions that will occur among the content, learner and teacher.

The sequencing of intervention activities (tactics) during the instructional episode can be heuristic, hierarchical or procedural. Merrill (1983) specifies instructional intervention components displayed in a heuristic manner. Reigeluth (1983) specifies instructional intervention elaborations in a hierarchical manner which lead to an epitome. Gagne, Briggs & Wager (1988) specify nine events that should occur sequentially during the instructional episode. During the instructional episode teachers engage themselves professionally in educational activities. They set tasks for learners, they motivate learners, they facilitate learners in controlling their efforts, and they help learners to improve their understanding and skills. This further supports the concept of the instructional environment being a complex entity. Principles or rules are postulated in order to understand complex entities. Principles offer effective and acceptable guidelines, and relatively reliable relationships between actions and outcomes.

The effectiveness of instructional episodes is enhanced when the interventions that occur during the content-learner-teacher interaction described above are part of a systematically planned strategy. Such a plan for instruction is the product of the instructional design process. Instructional Design is the process of creating a detailed plan that describes an instructional episode. The instructional design plan serves as a blueprint for the subsequent development, diffusion and evaluation of the instructional episode. The information required to initiate the instructional design process is obtained through a needs assessment. The needs assessment is necessary to planners of instructional episodes when generating an instructional analysis. Instructional analysis is the key to the entire design, development and evaluation process. The results of an instructional analysis and the ensuing outcomes that are derived from the instructional analysis provide the standards by which all instructional improvements are measured.

Four Components

As a discipline, instructional design is concerned with understanding and improving one aspect of education: the process of instruction (Reigeluth, 1983). Instructional designers have as their principle objective to induce targeted learners to perform in prespecified ways; to achieve results by developing and implementing documented and replicable procedures for organizing the conditions for learning; and by defining and measuring the accomplishments of instructional design in terms of learner performance (Burkman, 1987). The optimum effects of how student learning is facilitated and what actually occurs in the classroom environment determines what we do when we design instruction which is different from what we do when we develop instruction. To better understand the differences between the design and development components, and the other major components in the process of improving instruction and instructional media, the following descriptions of four domains to consider when improving instruction are offered below.

1. ***Instructional Design*** The domain of design focuses on the organization of strategies and tactics that are supported by principles upon which instructional improvements can bestructured. Instructional strategies are the general viewpoints and line of action that one adopts in order to choose the instructional methods (Romiszowski, 1981); or a set of decisions that result in a plan, method, or series of activities aimed at obtaining a specific goal (Jonassen, Grabinger & Harris 1990), such as in a soccer game where the strategy is an overall plan of action to obtain a victory. Instructional tactics are the specific ways that one chooses to implement a particular method (Romiszowski, 1981); or specific actions that are used to enact the strategy (Jonassen, Grabinger & Harris 1990). An example of a strategy is when the soccer coach decides to use the "outside-walk" approach when playing against a team with a stronger inside running game. The strategy is then implemented by the players with a selection of tactics, such as a four-corner offense, zone defense or a five-passes-before-shooting offense. An instructional strategy may recommend motivating the learner prior to instruction. Such a strategy may be implemented by tactics such as arousing learner uncertainty, asking a question, or presenting a picture of the concept (Jonassen, Grabinger & Harris, 1990, p. 32). Instructional strategies describe a general approach to instruction by prescribing how to organize, sequence or present information within the instructional environment.

The process of formulating an instructional strategy with the appropriate supporting tactics begins with defining the scope of the instructional issue at hand, followed by a general purpose statement, and then focusing on an unambiguous educational goal. The scope is a macro-level entity which provides the instructional designer with a concise statement of the content topics to be covered. The scope briefly indicates constricting variables that delimit the presentation format. In addition, the scope describes salient attributes of the content, the learner, and the teacher. Relative to the scope is the purpose statement, another macro-level entity. While the scope primarily aids the instructional designer, the purpose statement aids the learner. The purpose statement provides the learner with a sense of the content information to be covered in a topic area — a rationale. The purpose statement presents a clear relationship between the learning conditions and the desired outcomes. Based on the stated purpose, a goal statement is generated. The goal statement is a micro-level entity which presents the aim or object of the instructional episode. The goal is a description of the category of human activity and is intended to focus the instructional design effort. Based on the goal statement, performance objectives are selected and sequenced to initiate and maintain the systematic improvement of the instructional episode.

Micro-level design decisions relate to a single instructional objective or goal, while macro-level design decisions relate to multiple instructional objectives (Merrill, 1983) or scope and purpose. The concept of scope -> purpose -> goal can be interpreted as moving from the macro-level to the micro-level, or as one encompassing the other (Figure 2).

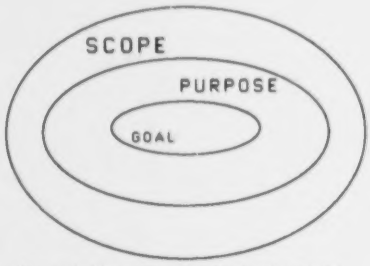

Figure 2. The goal as a miro-level activity within a macro environment.

An instructional design is a detailed plan that defines, describes and prescribes methods and procedures for the development, implementation, and management of an instructional episode. The instructional design also identifies appropriate evaluation criteria aimed at assessing strengths and weaknesses of the instructional episode. Instructional design is the initial phase in the instructional improvement process which takes into account the complexity of the variables within the CLT paradigm, and organizes their interrelationships and interactions in a meaningful way.

2. ***Instructional Development*** The object of instructional development is to produce from a detailed plan (design) the procedures and media to support the strategies and tactics of an instructional episode. These instructional procedures and media are created based on an organizing idea within the context of the subject matter. Presentation methodologies and media selection strategies are identified during the development and realized prior to implementation of the instructional episode.

The successful development of an instructional design often depends on the use of a heuristic. Heuristics are a collection of strategies and tactics employed by individuals which have been learned through experience. Basically, they are specific actions that have a history of success given certain conditions, and have matured to be accepted as a standard operating procedure. Such heuristics are appropriate as an approach to solving problems. For ill-structured problems, heuristics are often the only means to achieve a desired end. However, there seems to be increasing support for the belief that the problem structure is not the cause for concern, but, rather the structure of the educational system itself is in dire need of a comprehensive overhaul. Reigeluth (1987) argues that the major cause of the current problems with educational systems is the basic structure of the system. Whether it is the way we define problems or the educational system itself that is cause for alarm, it is evident that a clearer understanding of the relationships between instructional design and instructional development needs to be made thoroughly clear. Instructional developers utilize the information organized by the designers within the CLT framework to determine the best methods and media to achieve the outcomes that have been set out in the instructional design.

3. ***Instructional Evaluation*** Evaluation occurs continually throughout the entire development process (formative), and also after the instructional episode has been developed (summative). Data about how students learn specified content information under varying instructional conditions are obtained, analyzed and synthesized into meaningful information that can be used for making decisions regarding the design and improvement of instruction. Evaluation data collected during the instructional development process form the basis for revision of instructional procedures and materials prior to implementation.

4. ***Instructional Management*** This area is concerned with the supervision of the instructional episode, including pre- and post-episodic activities. Any process that involves movement toward a discrete location requires the use of guidelines for such, and the means by which those guidelines are initiated and navigated. Instructional management refers to the legislation, governance, monitoring and certification of the instructional design process. A total management commitment to use instructional design procedures is necessary to effect consistent results.

Conclusion

The viewpoint of this essay is that in order to improve instruction, two things must be requisite to such endeavor: (1) the relationship of education to instruction must be unambiguous, and (2) the components of the instructional creation and improvement process, namely design, development, evaluation and management must also be unambiguous. Instructional design professionals (Instructional Technologists), and classroom teachers who practice a systematic approach to instructional design during their teacher planning routines, are best suited to effectively improve instruction and instructional media.

At the most recent meeting of the Professors of Instructional Design and Technology (PIDT), the Definitions Committee presented its current definition of instructional technology; and the domains of instructional technology. Instructional technology as defined by PIDT (1990) "is a discipline concerned with the systematic design, development, evaluation, and management of instructon and instructional materials." The four domains of instructional technology and their relevant content areas as defined by PIDT (1990) are summarized in Table 1.

Table 1. Domains of Instructional Technology

Design	Development	Evaluation	Management
Instructional Systems Development	New Technologies	Needs Assessment	Resource Management
Message Design	Audiovisual Media	Formative Evaluation	Project Management
Instructional Strategies	Print Media	Summative Evaluation	Change Management
			Performance Technology
Research & Theory	Research & Theory	Research & Theory	Research & Theory

As recommended by the Definitions Committee of the Professors of Instructional Design and Technology (PIDT). Bloomington, Indiana. May, 1990.

It is of particular importance to make distinctions between the domains called design and development. Their relationship to one another should be described in unambiguous and non-conflicting terms. Whether the concept of design and the concept of development is compared or contrasted or sequenced, or if one subsumes the other, the fact remains that it is how these concepts relate to each other and how each is integrated into the instructional planning process that is important. It is equally important for the leaders of the instructional improvment movement to recognize and practice the distinctions of each domain in order to effectively research and broadcast the power of the systems approach to improving instruction.

As the instructional designer assumes the role of decision-maker, once again we witness an interactive environment which is complex. In this context decision is defined as choosing a course of action because it has the highest probability for success. An example of a sequence of instructional design decision points is:

1. the organizing idea,
2. the extent of the instructional preparation,
3. relevant information presentation strategies,
4. ratio of content-learner-teacher interaction,
5. ratio of student/teacher contribution toward the learning outcome,
6. amount of time devoted to each instructional component,
7. evaluation criteria about decisions, and
8. evaluation criteria about the decision-making process.

One method of accomplishing the complex task of improving instruction is to use creative instructional design strategies. Such creative strategies should employ such tactics as to:

1. Cautiously use a systems approach.
2. Avoid prefabricated relocations of ideas.
3. Respond to needs, interests and desires in unique ways.
4. Organize yourself to respond in a creative way.
5. Manage information to achieve new heights.
6. Explicitly specify the instructional parameters.
7. Maintain sensitivity and understanding.
8. Understand the motives behind the definitions.
9. Understand how problems are interpreted.
10. Employ nominal group techniques in order to generate genuine alternatives as potential solutions.
11. Retain the theory of attribution: I am in control versus it is all up to fate.

The instructional designer assumes major responsibilities within the instructional environment due to the complexity of issues associated with developing good instructional episodes. However, the instructional designer should feel she or he has a sense of control because the designer is responsible for the outcome of the instructional episode. As instructional designers, it is these areas of control that are the arenas for action toward the improvement of instruction.

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Course-Level Academic Processes as Indicators of the Quality of Undergraduate College Education

*John M. Braxton**

Considerable national attention has focused on the improvement of the quality of undergraduate college education. This concern is manifested in reports issued by the Study Group on the Conditions of Excellence in American Higher Education (1984), the American Association of Colleges' Integrity in the College Curriculum (1985) and the National Endowment for the Humanities To Reclaim a Legacy (Bennet, 1984). It is self-evident that if the quality of undergraduate education is to be improved, then quality must be defined in some way that useful information for the development of academic policy can be obtained (Ewell, 1988).

Two customary ways of addressing quality or excellence is to define it in terms of reputation and resources (Astin, 1985). The reputational approach defines quality in terms of a college or universities' rank in the pecking order of institutions (Astin, 1985). The U.S. News and World Report annual rating of undergraduate education is a good example of the reputational method of appraising quality or excellence. Thus, the higher an institutions perceived place in the institutional pecking order, the higher the quality of the institution. The resource approach delineates quality by applying such criteria as SAT or ACT scores of entering freshmen, the number of books in the institution's library or the scholarly productivity of faculty (Astin, 1985). Therefore, the higher the average test scores of entering freshmen or the larger the library collection, the higher the quality of the institution.

Jacobi, Astin and Ayala (1987) point out that both the reputational and the resource approach are highly interdependent, as an increase in reputation can bring additional resources to an institution and an increase in resources can also yield a greater reputation. At first blush, it would seem that information useful to institutional policy can be obtained from these two approaches. If an institution is able to increase either its reputation or resources, then the quality of the undergraduate experience will also increase. However, there are two problems with the usefulness of this information. First, as Astin (1985) points out resources available to most institutions are finite. Competition for the most able students and faculty is intense and most institutions will not be successful in such competition. Second, the relationship between financial resources and student outcomes is uncertain (Bowen, 1981). Thus, useful information for the improvement in the quality of the undergraduate experience may not be derived from either the reputational or the resources approaches to defining quality.

A third approach, which is embedded in the current attention devoted to assessment, is to define quality in terms of the effects of college on student cognitive and affective development (Ewell, 1988). Consequently, the greater the impact a college has on its students, the higher the quality of the institution. Astin (1985), in particular, advocates this approach, as he contends that it squarely addresses the education of students.

Although the outcomes approach is rooted in a concern for the education of students, the acquisition of useable information from this perspective on quality is somewhat problematic. A rigorous determination of the effects of the college experience on student cognitive and affective development requires attention to numerous methodology issues. For a review of such issues, I refer you to the Jacobi, Astin and Ayala monograph College Student Outcomes Assessment: A Talent Development Perspective (1987). However, the crux of these concerns is that there is a need for careful control of rival hypotheses to the unique influence of attending a particular college on the attainment of various student outcomes.

Another limitation to the outcomes perspective on quality is that reliable information on the relationship between educational practices and student outcomes is limited. In addressing the issue of whether there is a scientific basis for effective teaching, Centra (1990) points to the need for greater predictability in the relationship between teaching and learning.

In this text, I would like to advance an additional method of defining quality or excellence in undergraduate education, an approach which Robert C.

Nordvall and I have presented elsewhere (Braxton and Nordvall, 1985). This approach focuses on fundamental course-level academic processes and describes the quality of such processes in terms of the level of academic demands or rigor expected of students. Academic demands or rigor is defined in terms of the level of understanding of course content to be demonstrated by students while engaging in these processes. Examples of course-level academic processes are the type of questions faculty ask students during class, the nature of term papers or other written exercises, and the type of examination questions written by faculty.

The level of understanding of course content can be plumbed by applying a scheme such as Bloom's (1956) Taxonomy of Educational Objectives: Cognitive Domain to classify course-level academic processes. This well known taxonomy is composed of six major categories: knowledge, comprehension, application,analysis, synthesis, and evaluation. As these categories represent a hierarchy of increasing levels of understanding, a course-level process which requires a knowledge level understanding of course content is less demanding than one which requires an analysis level of course understanding.

Despite the compellingness of these categories, research (Krathwohl and Payne, 1971; Madus, Woods and Nuttal, 1973) has raised questions regarding the rank and operational independence of analysis, synthesis and evaluation. This research suggests that these three categories should be collapsed to form a fourth category which might be labeled higher-order thinking. Consequently, it is recommended that the knowledge, comprehension and application categories of Bloom's Taxonomy and a combined category representing higher-order thinking be used to classify course-level academic processes.

Some measure of construct validity for this approach to defining academic quality is provided by the findings of research by Braxton and Nordvall (1985). To test the assumption that more selective institutions do have higher academic standards, Braxton and Nordvall collected examination questions from faculty in four academic disciplines-biology, chemistry, history and sociology-at liberal arts colleges of two categories of undergraduate admissions selectivity (Liberal Arts I and II of the Carnegie Classification of Institutions, 1976).

The examinations collected were classified by two trained coders into the various categories of Bloom's Taxonomy. A pattern of differences between more and less selective liberal arts colleges on the level of understanding of course content tapped by course examination questions above and beyond the influence of academic discipline, course level, and whether the course was intended for majors or nonmajors was found. Examination questions requiring recall or recognition (knowledge level) of course content are asked more often at less selective liberal arts colleges, whereas questions requiring a higher-order level of understanding of course content are asked more frequently at the more selective liberal arts colleges.

Hence, this pattern of findings provides some support for the perspective advanced herein that academic quality can be defined in terms of the level of understanding of course content required by a course-level process such as examination questions. Currently, I am conducting research to extend these ideas to research universities. This project is being funded by the Vice-President for Research and Undergraduate Studies at Syracuse University.

Usable Knowledge for Improvement

The academic processes approach to the definition of quality is not a panacea. However, such course activities as examinations, questions asked by faculty in class and student written exercises are currently embedded in most undergraduate courses. Accordingly, a knowledge of the level of understanding being addressed by various course processes can yield useable knowledge for the improvement of the quality of the undergraduate experience. If it is determined that many course processes are demanding a knowledge level of course understanding and the faculty member is actually seeking a higher level of effort, then faculty can ask questions or assign written work which exact a higher level of understanding. Consequently, the quality of these processes would be improved by adjusting the level of understanding required.

Despite the manipulability of course-level academic processes, some faculty may require assistance in the crafting of class questions, examination questions and other such activities in order to tap higher levels of course understanding. Such assistance is the province of instructional and faculty development offices. Thus, instructional and faculty development offices can play a significant role in the improvement of undergraduate instruction.

In addition to the role of instructional and faculty development, academic policy can be established which seeks to raise the level of academic standards in undergraduate instruction by requiring a higher level of course understanding to be manifested in course-level academic processes. The appeal of this approach is that academic standards could be raised in most colleges and universities by demanding a higher level of under-

standing of course content. The level of understanding—application or higher-order—sought could be a function of the academic ability of enrolled students and the goals and mission of the institution. Moreover, increments in quality could be accomplished with a minimum of additional resources.

Colleges and universities interested in applying this approach to defining academic quality should begin by conducting reviews of the level of understanding of course content being tapped by various course-level processes in selected academic departments. Such information could be collected as a facet of ongoing academic program reviews. After gaining an understanding of the current level of understanding exacted, academic policy could be implemented to encourage increments in the rigor of course activities if deemed necessary. Systematic review of course-level processes is a necessary first step toward the acquisition of useable knowledge for the improvement of the quality of undergraduate education.

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PROJECT ADVANCE SURVEYS SCHOOLS AND COLLEGES PARTNERSHIPS

Syracuse University's Project Advance is best known as a shcool-college partnership offering accredited college courses taught in high schools. In addition, Project Advance administers a National Partnership Database containing information on more than 1400 school/college partnerships nationwide. This past year a new National Partnership Database was created as the result of a comprehensive survey which was conducted on all accredited American postsecondary institutions.

A second product of the sturvey is the publication *Linking America's Schools and Colleges: Profiles of Partnerships and National Directory.* This publication provides an overview of the school/college partnership movement and profiles over 200 partnerships in detail, describing how each partnership began, who it serves, how it is funded, and what its impact has been on students, teachers, and the curriculum. The publication also lists another 1200 partnerships from across the country, representing a broad range of programs, practices, and services. Contact names, addresses, and phone numbers for the partnership programs are included. The book also provides instructions for accessing, and contributing to, the national computer database.

Structural Communication: A Forgotten Application of Cognitive Theory to Instruction

*Wende S. Pusch and Elisa J. Slee**

Introduction

One purpose of instruction should be to help the learner gain a better understanding of his or her world. To do this the learner must be an active participant in learning. This active participation allows the learner to integrate new material into existing knowledge leading to deeper processing (Craik and Lockhart 1972) resulting in greater retention of new information. Therefore, instruction should be designed to encourage learners to actively participate in learning. One instructional method that attempts to engage the learner in active processing is Structural Communication (Egan, 1976). This article will first discuss the "cognitive" approach to learning and then describe the Structural Communication method in the context of this approach. We will then review the existing research on Structural Communication and present further suggestions for inquiry.

Cognitive approach to learning

Over the past two decades there has been a shift from "behaviorism" to "cognitivism" in examining learning. The primary focus of the "cognitive" approach to learning is on how processing affects the understanding and retention of information. This approach is said to be learner centered and is concerned with cognitive processing with an emphasis on the mental models of the content constructed by the individual learner. Whereas some cognitive psychologists have examined processing in terms of long and short term memory, Craik and Lockhart (1972) focused upon levels of processing. This approach considers what factors influence depth of processing, such as prior knowledge and overt or covert activities.

Levels of processing theory looks at retention of information as related to the depth, or spread, of encoding. The theory suggests that the deeper information is processed the longer the memory trace will persist. But what does this have to do with the building of mental models and understanding of material? The depth of processing is also related to the degree to which information is organized in memory and related to prior knowledge. The level to which information is processed is related to the degree that the information is analyzed and organized by the learner. In terms of classroom "instruction", how does this "levels of processing" model compare? Let's consider an example. When a teacher is introducing a science unit on the principle that hot air rises, he or she might ask students to think of examples of this phenomenon in their daily lives. A "good" teacher does this because he or she knows that if the students have some living example they will be better able to create a link to the content presented in class, and consequently organize and remember the information better.

Methods of instruction contain a vast number of activities that purport to promote various levels of processing. Some activities that promote processing at one level are rehearsal or repetition. This is a technique often used when learners are trying to memorize information and while it does lead to the formation of a memory trace it is not one that is very permanent.

Activities that promote more permanent memory traces, hence deeper processing, are activities that require learners to analyze and organize information. These activities also promote the relation of new material to prior knowledge. The use of these activities to promote deeper understanding of material are discussed more specifically in Wittrocks' (1974) generative model of learning. The basic premise of the generative model is that the learner is not a passive receptacle of information, but that the learner actively constructs his or her own meaning of material. This active process results in the understanding of material. Wittrock proposed that generative strategies do exist that facilitate this process. Examples of generative learning strategies include imagery, illustration, and the generation of summaries, headings, inferences, outlining, critical comments, analogies, and concept mapping (Linden and Wittrock, 1981).

The generative model of learning is based on studies in memory and retention (Wittrock, 1985). Generative strategies increase the processing load by learners, thereby affecting depth of processing. Mayer (1984) has

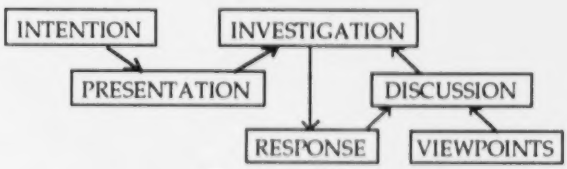
referred to the encoding process as one of making internal connections. Organizational and elaboration strategies are one way to enhance this building of internal connections; for example Weinstein and Mayer (1986) mention that methods that help learners to develop the ability to determine the internal connections between ideas in a passage will facilitate deeper processing. One way to help learners build internal connections is to develop instructional units that will encourage them to see the connections between ideas in a passage.

A method that could encourage this would structure learning in a manner designed to promote "higher level, synthesis learning" with the goal being understanding. Such a method was developed in the late sixties. This method is called Structural Communication (Egan 1972). Understanding is "inferred if a student shows the ability to use knowledge appropriately in different contexts, and to organize knowledge elements in accordance with specified organizing principles" (Egan, 1972, p. 66). We will now describe Structural Communication.

Description of Structural Communication

Structural Communication was developed in the late sixties and early seventies. The typical components of a Structural Communication unit are intention, presentation, investigation, response matrix, discussion section, and viewpoints. Each of these is described below. For more detailed description see the Job-Aid section of this issue.

Diagram 1: Main Pathway through a Study Unit



Intention: An overview of the case study presented by the author. The intention is used to provide a context for the content of the study unit.

Presentation: This is the subject matter of the study unit. This could be anything from a text based passage to a novel or a play. This could also be any sort of computer mediated instruction, including simulations.

Investigation and Response Matrix: There are typically between three to five problems about the content of the presentation. A learner investigates the problems by selecting items from the response matrix. The response matrix is comprised of facts, theories, and principles about the subject of the presentation. Learners select items from the matrix that they feel are relevant to a particular problem. The same matrix is used for all of the problems presented, and any given item can be selected for one or more problems.

Questions typically require higher level analysis of the material requiring the learner to organize and interrelate various aspects of the presentation. The items in the response matrix provide a starting point for organizing the material, providing an aid to comprehending the material. This organizing exercise encourages deeper processing of the content.

Discussion: The discussion section includes both a response analysis and comments. The learner is directed to discussion comments by means of the response analysis. (For example, the response analysis might read, "If you included three or more of items 2, 4, 7, 8, 30 from the response matrix you should read comment A.") The discussion comments are used by the author to guide the student in analyzing the problems under investigation and may explain how certain items which were included or omitted were of primary or secondary importance. The comments may highlight inconsistencies or deficiencies in the learners choices as well as present relationships between various aspects of the presentation as it relates to a given problem. If the learner is unable to determine the relationship between concepts, facts, principles then Wittrock's Generative Model of Learning suggests that the relationships should made explicit (Weinstein and Mayer, 1986).

Viewpoints: Finally the authors may present their viewpoint or biases on the content of the study unit. This section can also be used to summarize the unit or direct students to further reading or activity.

A learner studies the material in the intention and presentation sections, and then proceeds to the investigation. The problems serve to challenge the learner to identify and make connections between the various aspects of the subject matter being investigated (Egan, 1974). He or she constructs a response by selecting items from the response matrix. This encourages the reader to make links between the items that have no apparent connection. This activity requires that the learner carefully analyze and interrelate the presentation material when generating a response. This activity promotes deeper processing of the material to be learned.

Based upon the responses chosen, the learner is then directed to specific discussion comments that compare and contrast certain misconceptions and viewpoints. It

is the discussion comments that distinguish this method from other variations of "programmed instruction". The author of a Structural Communication study unit writes the discussion comments in advance, and there is no "right answer". Rather, the author attempts to anticipate particular responses that a reader might select when using the matrix and writes the discussion comments such that they serve to assist the learner in further analyzing the information. For example, if a certain response pattern indicates that a reader has only selected matrix items of secondary importance the comment would highlight how these were related to the study and also point out other factors that should be considered. Upon completion of the study unit the author may decide to summarize his or her opinion in the section called viewpoints.

The ensuing student/unit interaction may be evaluated by determining the degree to which the learner's responses demonstrate a synthesis of the material. This can be done using a coherence index which is a measure of the learners understanding of the study unit. The author will weight items in the matrix for each problem based on its importance to the problem. Weightings typically range from -2 to +2, where the +2 rating indicates that the student has identified an item of critical importance based on the viewpoints of the author. A -2 weighting is assigned by the author to items that have no relevance to a particular problem. Weightings for matrix items will change for each problem. The coherence index is calculated by adding the weightings of the items selected by a learner. A larger coherence index indicates a closer agreement with and understanding of the author's viewpoint.

Research on Structural Communication

While there have been several articles describing the uses and examples of Structural Communication study units (see, for example, Egan, 1972; Egan, 1976; Hodgson & Dill, 1970; Hodgson & Dill, 1971), limited research on this method has been reported. Hodgson and Dill in three articles in the Harvard Business Review describe a Structural Communication business case study exercise. Readers were invited to mail in their responses. A coherence index was calculated for each of the readers responses collected. One notable result was that the reader response was higher than for any other case study presented in the Harvard Business Review. In addition the coherence index improved over problems one through four, suggesting that a certain skill was involved in using this instructional method. Romiszowski (1976) performed a feasibility study that compared existing materials for teaching set theory including Fyfe and Woodrows' (1969) Structural Communication unit on the subject matter. This unit was found successful in teaching concepts and principles of set theory at a greater depth of understanding. However, the Structural Communication unit was found to have limitations based on the reading level of the learners. This is not a limitation of Structural Communication, but of the specific materials used. A unit entitled "Anglo Saxons" (1969) was used successfully at the primary grade level. This unit is a teacher delivered unit with the questions presented on flash cards.

Mitchell and Meilleur-Baccanale (1982) compared Structural Communication to regular textual presentation. The subjects were undergraduates studying systems analysis. Eighty-one subjects were tested on immediate recall and understanding as well as delayed understanding. The experimental group using Structural Communication out scored the prose group by 58% on the test of immediate recall. Similarly the Structural Communication group scored 51% higher on the delayed post-test. The authors concluded that Structural Communication was superior to regular textual material for this particular subject matter. The authors also investigated whether there were any differences in recall and understanding between learners classified as "wholists" and "serialists". While the authors did not find any significant differences in this study, they attributed it to unequal sample sizes in the cells, in particular few serialists actually completed the Structural Communication units. In terms of comparing the Structural Communication unit with regular textual presentation, one might say that Structural Communication forces learners to engage more in the processing of material. The comments can serve to aid in the analysis of information, thus improving the post-test scores. The control group was allowed to review the text for as long as they wished, however, there was no "structure" to this unlimited review time, therefore the information might not get processed.

In a more recent study, Mitchell and Emmott (1990) investigated a print based version of the case study published earlier by Hodgson and Dill in the Harvard Business Review (1970). They compared the print based study to one automated on a computer and hypothesized that individuals classified as "serialists" or "surface processors" would perform less well than "wholists" or "deep processors" as measured by the coherence index. They also hypothesized that the coherence index for all subjects using the computer version would be greater than for those using the the print version. Their results generally supported these hypotheses. However, the wholists only out performed the serialists on the paper version of the case study exercise. Mitchell and Emmott (1990) suggest that the paper version calls for more processing on the part of learners since they have to analyze for themselves which feedback comments would be relevant. The

computer-based version supplies this prescription automatically.

Romizsowski, Grabowski, and Damadaran (1988) examined the use of Structural Communication as a supplement to instruction via interactive video (IV). The authors noted that on successive trials of an IV business case simulation, learners did not improve their scores. They designed a Structural Communication unit for the purpose of "debriefing" students in order to increase processing of information. Students who participated in the Structural Communication debriefing exercise did in fact improve their scores as they worked through the Decision Point simulation during a second trial. This suggests that the Structural Communication debriefing helped learners to analyze the case study information more effectively than the IV presentation alone and thereby acting as an aid to deeper processing. A computer-based version of the debriefing exercise has been developed (Romizsowski, Grabowski, and Pusch, 1988). This includes two versions, one with "short" question stems and one with "long" questions stems. The "long" question stems are hypothesized to provide some orienting information related to questions. This investigation is currently underway and hopes to determine whether orienting information aids in processing by providing a link to the learners' prior experience with the simulation.

A study by Taylor (1990) investigated how the use of concept maps affected performance on Structural Communication on Nutrition. Thirty undergraduates were randomly assigned to three versions of the units: study units with instructor generated concept map, learner generated concept map, and no concept map. It was found that learners who used either instructor generated or learner generated concept maps out performed the group that did not use this strategy at all. While the mean score of the group than that generated their own map was higher that with the instructor generated map, the difference was not statistically significant.

Since Hodgson first described Structural Communication in the late sixties, a number of study units were produced in both the United Kingdom and the United States (Whittington 1974). In a paper which aimed to suggest further directions for Structural Communication, Hodgson (1974 a) stated that "it is probably misleading to conceive that Structural Communication can be provided in a self sufficient paper form" (p.6). In addition he indicated that field work in the United Kingdom suggested than the use of prepared dialogue is less motivational that unprepared dialogue. This suggests that Structural Communication in its original form may be too constrained. An investigation using mainframe technology to present a Structural Communication case study in management information systems is currently underway. Two versions of the case study are being evaluated to determine how they differ in getting students to interact. In the first version, students input the response matrix items into the computer and the computer program performs the analysis of the learner's selections and presents the comments to the students on the screen. This is much like typical computer based training where there is high degree of system control. In the second version, students input their selections and are then presented with the response analysis algorithm and allowed to determine which comments they should and would like to read. Learners in this version may decide to read any or all of the comments. In order to make Structural Communication less constrained, learners are given the opportunity to make a comment after each problem is completed. In addition, learners are directed to make comments via electronic mail to the instructor. This allows for increased interaction between the learner and instructor and questions the current design of computer-based instruction which often fails to accommodate individual reactions to instruction.

In the literature in the field of Educational Technology, people have described a shift in instructional theory from "behaviorism" to "cognitivism". Such a shift advocates paying more attention to the individual learner and how one processes information. Still, if one examines current computer based instruction, despite labels such as "interactive video", the products appear to be interactive only in terms of their hardware interfaces. How does one translate instruction with technology such that it incorporates what the "good" teacher is said to do so well? Structural Communication may be an instructional method worth examining as a step towards a better implementation of "interactive" instruction. It could be used to design computer based instruction because it starts a dialogue with a learner that encourages deeper analysis of information. In addition, this technique could be supplemented by off-line tutorial dialogues or electronic mail in order to continue the dialogue started when the learner is presented with the matrix and first set of discussion comments. In addition, future inquiry might examine how Structural Communication combined with other generative activities, said to aid in the processing of information (e.g.. concept mapping), can further increase the learners' understanding of content.

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THE SYRACUSE-DUTCH CONNECTION

A quiet but active International R&D exchange program between Instructional Design, Development and Evaluation (IDDE) at Syracuse University (SU) and Toegepaste Onderwijskunde (TO) at the University of Twente (UT) in The Netherlands is almost ten years old. During that time, three IDDE faculty members have spent 3-6 months at the Dutch University and four TO faculty have taught at Syracuse University. One graduate student from TO has finished a Master's degree in IDDE and the first IDDE representative is expected to carry on advanced research at Twente soon. Two students groups from DO and a contingent of Dutch educators have visited SU. IDDE sponsored a group of American educators for an educational technology study tour of the Netherlands. And so it goes. Why all this activity?

At first it seems to be an unlikely match: IDDE with 9 faculty and TO with 31; IDDE with about 75 graduate students and TO with about 300 undergraduates; IDDE with relatively small space on the third floor of Huntington Hall and TO in two buildings; IDDE more than 40 years old and TO just celebrating its 10th anniversary. Yet there is community between the two programs that brings professionals with common interests together across the waters. The match was made official with the signing of a cooperative agreement in 1981 and a renewal of that agreement in 1989 with an extension to 1994.

The cooperative agreement calls for infor.nation exchange, faculty exchange, student exchange, and collaborative research. Each university has named a coordinator, presently Alex Romiszowski from SU and Sanne Dijkstra from UT. The first coordinators were Don Ely and Tjeerd Plomp.

Each faculty exchange visit is unique to the individual and the institution. In general, each person offers a course, gives a colloquium presentation, meets with faculty and students to discuss matters of mutual interest, and pursues a personal research and writing program independently or in collaboration with a counterpart colleague. Don Ely (SU) has jointly edited a special issue of the International Review of Education with Tjeerd Plomp (UT); Alex Romiszowski (SU) and Martin Mulder (UT) have co-edited Strategic Human Resources Development. John Keller has published a conference paper with Jan Muller. Other efforts are currently underway.

The story behind all of this activity began when Tjeerd Plomp from TO visited IDDE in 1978 to look into the educational technology curriculum. The University of Twente (then Technische Hogeschool Twente) was in the process of developing a curriculum in Education with emphasis on technology. The planning process took three years before the first students arrived in 1981. Don Ely and Mike Molenda (SU alumnus, currently Chair, Instructional systems Technology at Indiana University) shared a one year Research Fellowship during the last planning year. Subsequently, Ely returned to UT in 1984, 1986, 1988 and 1990 for 3 month periods. John Keller (ex-SU faculty, now at Florida State University) and Alex Romiszowski both held 3 month Research Fellowships during that time. The IDDE curriculum has had a major influence on the TO curriculum and continues that influence through its faculty presence.

TO is a larger program—a College of Education in itself. Its five departments are: Curriculum Technology, Instructional Technology, Educational Instrumentation Technology, Educational Administration and Educational Measurement and Data Analysis. It also encompasses an education research and development center funded by the Ministry of Education and Science and is the international headquarters for the Computers in Education study, a project of the International Association for the Evaluation of Educational Achievement. Egbert Warries was the first TO faculty member to teach at SU. Later, Tjeerd Plomp, Sanne Dijkstra and Jan van den Akker came for periods of three weeks to three months.

The larger scope of TO brought about an expanded agreement with the entire School of Education rather than just with IDDE alone. This expanded agreement has already attracted attention from faculty in Higher Education and Adult Education for potential future exchanges.

An International R&D program such as this depends upon people and communication. Frequent e-mail (BITNET) exchanges facilitate ongoing cooperative efforts. A large TO contingent at American Educational Research Association (AERA) provides opportunities for meeting, planning and exchanging ideas with SU colleagues who also attend the same conference. Computer and teleconferences have been held. International conferences serve as additional grounds for meetings. The important connections are person-to-person: individuals who hold common values and goals and who work together can yield more than each person's individual output. These connections have been made, are currently being made, and will continue to be made. Such connections are the stuff of life for professionals who refuse to be bound by institution, state or national boundaries. The connection is truly an international network.

Interpersonal Skills: Critical Attributes for Instructional Developers*

*Ruth V. Curtis and Darlene Nestor***

As students in instructional development academic programs enter the field, they quickly discover that their professional success depends largely upon a combination of technical and interpersonal skills. This article identifies five areas of ID responsibility, specifies several interpersonal skills critical to successfully fulfilling those responsibilties, and includes comments from students who participated in an academic program designed to help them build and enhance those skills.

Instructional development is a hands-on, "action" profession. It requires the utilization of specific skills and techniques to analyze, produce, implement and assess instruction. Instructional development professionals report that to be successful requires a repetoire of potential strategies and techniques for working with clients, subject matter experts, subordinates, colleagues and others.

Although most academic programs in instuctional development adequately prepare their preservice professionals in the technical skills, knowlege and experiences needed to get the job done, they generally lack opportunities for building and enhancing interpersonal skill competencies *for working with people* to get the job done. Although they may know how to write objectives, sequence content, design evaluation instruments and develop support materials, they may not be as well prepared to interact with a reluctant SME, manage a diverse ID team, or present a completed project to a client.

Such situations demand special competencies that require skills that are not part of a typical academic program in instructional development. These competencies have been identified by AECT's Division of Instructional Development Task Force on Instructional Development Certification (1981) as (1) effective communication skills (visual, oral, written) and (2) interpersonal, group process and consulting behaviors. The need for such "people skills" has been supported by professionals in the field in a number of articles (e.g., Schiffman, 1986; Coldway and Rasmussen, 1984; Wallington, 1981; Deden-Parker, 1979).

A "typical day" in the life of an instructional developer may include any or all of the following areas of responsibility:

- initial client meetings
- information-gathering interviews
- internal reviews
- client reviews
- team meetings

These five areas represent the five units of instruction in a course entitled "Interpersonal Skills for Instructional Developers," offered to graduate students in Syracuse University's Area of Instructional Design, Development and Evaluation in the fall of 1988. A brief description of each of these units and the skills taught is presented below. Several related comments made by students who had participated in the course are included.

Initial Client Meetings

Establishing immediate rapport and creating a positive first impression with a client help to ensure a pleasant and successful ID project. This requires thinking about key verbal and nonverbal cues, such as dress, body language, positive attitudes, etc. It is essential to be deliberate about projecting a positive image to a client, especially during the initial meeting.

Critical Skills: Verbal and nonverbal communication, the use of power, skills for establishing rapport.

> "It is amazing how vital politics can be and how the areas of trust, being non-threatening, supportive, empathetic, and being able to communicate are crucial for the effective ID'er."

Information-Gathering Interviews

In cases where the instructional developer has not established rapport with the client (who may be a SME) in the initial meeting or didn't enter the project until the information-gathering stage, it is important to be thoroughly prepared to establish credibility while maintaining that of the client. This can be accomplished through careful wording of questions, focused attention, effective listening strategies and frequently testing your understanding of the subject matter.

Critical Skills: interviewing, listening, questioning techniques.

> "I found I have a great deal of difficulty with reflective listening without turning it into a question. This...became an effort to concentrate on how to rephrase items as opposed to questioning and asking for clarification. I have practiced this...I think it will be a helpful technique to use."

Client Reviews

The client interview may or may not be with the SME. Although the level of rapport established during initial meetings, content knowledge acquired and detail of the draft submitted for review may influence this relationship, in some cases, when the client is the SME, some negative feedback about the training design may result. When this occurs, it is important for the instructional developer to view the comments as constructive, respond neutrally, maintain control, address the problem and move on. Once the problem is resolved, the project can proceed.

Critical Skills: motivation, creative problem-solving, feedback techniques.

> " I...specifically asked (my boss) to explain which helped me understand what she was trying to communicate to me and served to defuse and reduce her excited state."

Internal Reviews

In most training organizations, development work is reviewed before the client sees it, which means accepting feedback from one's colleagues. In some cases, this requires actively listening to their suggestions and comments and, if possible, acting on them. In other cases, it requires standing by your work, even when a colleague has criticized it, while acknowledging the value of receiving the colleague's feedback.

Critical Skills: negotiation, conflict resolution, feedback techniques.

> "...(H)ow we interact with people has a strong impact on how they respond to us. I've been...in situations where I've felt that every attempt I made to do a good job was met with disinterest, criticism, or some other form of negative feedback."

Team Meetings

Most instructional developers do their work within a team context. It is essential that the roles of each team member and the goals of the team are clearly articulated. At the initial phase of the project, agendas, timelines, goals, objectives, roles and responsibilities must be defined and agreed upon through timelines, task lists, and discussions.

Team meetings and discussions require closure. While individual needs, personalities and styles must be acknowledged, issues and concerns must be resolved. Expert managing of individuals and groups increases individual performance and achievement.

Critical Skills: team building, conducting effective team meetings, making persuasive presentations.

> "(This experience) will help me to better plan and lead meetings and will help me feel more confident in such situations."

After completing the pilot course "Interpersonal Skills for Instructional Developers," sixteen graduate students enrolled in Syracuse University's Area of Instructional Design, Development and Evaluation agreed that the most positive outcome of having taken the course was in gaining or increasing their awareness of how interpersonal skills fit within their own personal styles, the potential effects of interpersonal competence on the ID process, and techniques for integrating them with the more technical ID skills learned in other courses. The course was intended to integrate classroom learning with real and simulated work experiences.

The goals of the course were to (1) provide students with an overview of important interpersonal skills; (2) raise students' awareness of their leadership, management and communication styles; (3) develop students' ability in problem solving and effective management of various human behaviors; and (4) provide students with information about a variety of resources available to assist them in further developing their interpersonal competencies.

The content of the course included skill-building in active listening, making presentations, conducting meetings, negotiating and conflict resolution, problem solving and interviewing. In self-evaluations completed directly following the end of the course, and five months later (when they were actually working in the field), students reported a gain in competence in all of the above skill areas and stated they had already used some of those skills on the job. All acknowledged the importance of such a course.

> "The course filled a lot of gaps resulting from an intensive design and development emphasis in our program. We designers need to work with clients to do our jobs well. Therefore, we should practice/develop interpersonal strategies to do so."

Positive interaction with clients and colleagues is vital to the success of any instructional development project. Interpersonal awareness and skill-building are essential components of an academic program that prepares professionals for careers in instructional development.

> "This course provided me with a good grasp of concepts, helped me define various skills or behaviors and served as behavioral models for me. It helped stimulate my thinking about topics I hadn't considered."

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STUDENT LITERACY CORPS PROGRAM ADDRESSES LOCAL LITERACY NEEDS

According to U.S. census data and estimates by Syracuse area community service agencies, nearly 50,000 adults in Onondaga County are functionally illiterate, and many more individuals do not have high school credentials. In addition, the number of adults in the Syracuse area in need of basic education continues to increase.

Faculty and students of the Interdisciplinary Institute on Literacy and the Adult Education Program at Syracuse University will address this need through the Student Literacy Corps Program. This project, funded for two years by the U.S. Department of Education, includes the development of an undergraduate, four-credit set of two courses on adult literacy education. This set of courses, to be offered initially in Fall 1990, combines academic study with field placement in local adult literacy and basic education programs. The project provides opportunities for undergraduate students to augment course work with six hours of supervised literacy tutoring in the Syracuse area.

Tutors in the Student Literacy Corps Program will provide supplemental instruction to low literate adults in basic education classes offered by the Syracuse Educational Opportunity Center (EOC) and the Onondaga-Cortland-Madison Board of Cooperative Educational Services (BOCES). These agencies offer classes to adults in basic reading and mathematics as well as high school equivalency and job training. The university course will provide student tutors with an assortment of instructional strategies as well as with the opportunity to explore a broad range of perspectives tied to literacy and adult learning.

In creating the project, the Syracuse University faculty benefitted from the assistance of several public community agencies in the Syracuse area. These agencies include Literacy Volunteers of Greater Syracuse, The Syracuse Educational Opportunity Center, and the Onondaga-Cortland-Madison Board of Cooperative Educational Services. In addition to these agencies, Literacy Volunteers of America, Laubach Literacy Action, the SU Student Government Association and Greek Council, and Niagara Mohawk continue to provide representatives to serve on an ongoing project advisory board.

The project will provide an opportunity for undergraduates to be involved in important community work. Other goals are to improve literacy education, and to enhance undergraduates' knowledge, skills, and attitudes about adult literacy. Data collected on the project outcomes is expected to be significant to practioners and researchers concerned with improved adult literacy instruction.

The Students Literacy Corps Program is receiving enthusiastic support from university administrators and Syracuse area community agency directors. It is envisioned that the program will receive continued support and ultimately become a regular part of university course offerings. The program will also provide a model for adoption in other college and university settings where there is interest in more effective community involvement for students.

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Planning for Success: College Distance Education Programs

*Lynda Hanrahan**

Over the past two decades, there has been an incredible proliferation of distance education programs throughout the U.S. and internationally. Distance education brings the course to the student, rather than the student to the campus. Instruction may be delivered by one or a combination of media, including print, broadcast, audio or video recordings, or even by computer or interactive video.

Teleconferencing and videoconferencing systems are being utilized for all levels of education – from elementary school through college and into the workplace. Each year, over $150 million in training dollars is spent for "teletraining" by business and industry. In academia, distance education programs provide thousands of non-traditional students with opportunities for lifelong learning.

Syracuse University (S.U.) has become one of a growing number of "traditional" academic institutions which have developed a distance education program to meet the needs of students who must earn while they learn. However, the move into distance education at S.U. has not been smooth.

The process of adopting an innovation by an established institution is rarely smooth. The fits and starts of the adoption process are often the norm. For those who manage college distance education programs, there is often an unstated, but important goal to increase acceptance of the program by faculty and administrators. Diffusion research, especially that of Everett Rogers (1983) provides a good source of strategies managers can use to increase acceptance of distance education programs meeting the needs of continuing education students. This paper examines the S.U. experience in relation to the particular characteristics of the innovation that may eventually determine the success of the program.

Barriers to Distance Education

There are still many barriers to the adoption of distance education and other media-based instructional methods in higher education. Two of the most tenacious barriers that generally crop up are strategic planning and faculty resistance. Poor planning and administration can have a devastating effect on these programs. On the issue of resistance, Koontz (1989) and Evans (1968) report that college faculty may believe any number of myths and misconceptions about television teaching: the courses are not as rigorous; the quality is generally poor; instructional television is ineffective; telecourse students lack direct faculty-student contact and therefore the motivation to work hard in the course. In addition, many faculty resist the notion of off-campus learning and have little or no sympathy for students whose life situation does not permit them to attend college in a traditional way (Lewis and Wall, 1988).

Distance education is an innovation in academia, since most academic institutions do not yet have such programs. College courses are taught in much the same way they have been for centuries, with students required to attend classes on campus. For those colleges that do offer distance education, the programs often take a back seat to the "real" learning that takes place on the campus. These programs have been called the "stepchildren of college courses," because even though they get high marks from students, faculty and administrators may see them as good for public relations but out of the mainstream of higher education (Managan, 1989).

A Pragmatic Solution

For over thirty-five years, University College (U.C.), S.U.'s continuing education division, has provided a modified type of distance education for engineering students. Instead of sending educational programs to the students, it sent its engineering faculty to conduct classes at its Graduate Centers located in New York at Poughkeepsie, Endicott and Utica/Rome. Corporations in these areas sponsored their engineers into the program to upgrade skills, secure an advanced degree or keep abreast of technological advances. The sheer pace of changing technologies in engineering demands that engineers must continually learn to stay current in their field. Large enrollments in the off-campus Centers have brought many students into full-time study at S.U., and have maintained good public relations with corporate clients.

Enrollments in the Centers surged for a while and have now leveled off. There are several reasons for this:

more engineers with advanced degrees have been hired, the corporations are downsizing which means fewer new hires, and there is increased competition from engineering programs offered by other universities such as RPI, Columbia, Virginia Tech and NTU (National Technological University). These institutions have been using distance education programs longer than S.U. has. NTU, for example, broadcasts telecourses (developed by engineering colleges) throughout the United States and grants engineering degrees to students who complete the NTU program.

As enrollments changed at the Centers, U.C. began to look for ways to maintain the full complement of engineering course offerings without increasing costs. Some courses had to be cancelled due to low enrollment. It was no longer cost-effective to send a professor to one site to teach six or seven students. To maintain a strong off-campus program, U.C. had to look to alternative means to deliver courses. If the courses could be taught at all three sites and managed by one instructor, the course could be offered. Distance education was an obvious solution, especially because the corporate clients were already receptive to this method. S.U. seized an opportunity to apply for a National Science Foundation grant to develop satellite uplink capability. The grant was approved and with matching monies from corporate and local sources, S.U. installed the uplink in 1987.

Developing the Program

Early in the development process, U.C. arranged with the Center for Instructional Development (CID) to deal with two primary concerns they had for the program: quality of instructional materials and administrative coordination. CID provides support to Syracuse University faculty and academic departments to improve courses and curricula. In this instance, CID was to work with engineering faculty to develop and produce videocourses, which would be taped live, duplicated and sent via courier to the three Centers. Full use of the uplink would come later, after the initial experiment proved successful.

CID spent a considerable amount of time working with the first faculty volunteers, helping them to translate their instructional materials into high-quality, camera-ready graphics. An experienced videocourse instructor estimates that it takes twice as much time to produce these materials, but he covers about 40% more material because the course is so well organized. The television graphics are also turned into a set of course notes that are distributed to the students. Having the hard copy in hand compensates for any loss of quality in the final television image.

CID also developed and provided two other key pieces for the program: coordination of the video production and administrative aspects, and the evaluation component.

Formative evaluations initially showed that the videocourses were received half-heartedly by the students. Many students complained about the lack of immediate interaction with the instructor (a common problem with media-based courses). Within a short time, student attitudes became more favorable because they found the videocourses to be flexible (especially if students had to go out of town for work), useful for reviewing, and well-produced. In addition, many students realized that a broader selection of courses was available with the videocourses.

The taped videocourses proved to be a successful venture for U.C. Even with start-up and development costs, the experiment demonstrated that the distance education program could be cost-effective. The next stage was to use the satellite uplink. This process proved to be more complicated than anyone would have thought! Establishing downlinks that would serve our corporate clients, as well as independent students was difficult, at best. A major corporate client which had insisted that U.C. offer telecourses via satellite, could not actually receive (downlink) the courses. CID had to make elaborate arrangements to downlink elsewhere, then retransmit to the corporation or to our Graduate Centers. In addition, we were asked to work around another college's broadcast schedule. Eventually, these kinks have been worked out. U.C. plans to establish a downlink at each Graduate Center to avoid the more complicated downlink arrangements.

Problems with Strategic Planning

During the past two years, U.C. has struggled to put together an advance schedule of telecourse offerings. This is needed to secure satellite time and to promote the courses. It also allows students to plan their courseload for a logical sequence of courses. Until recently, it was difficult to create an advance schedule because faculty regarded telecourse teaching as voluntary. Their research activities often interfere with the intense development activities needed for the telecourse.

U.C. has tried various facilitative strategies to engage engineering faculty to volunteer to develop their courses for use in this program. Some of the strategies used were:

(1) conducting informational sessions to describe the development process

(2) providing support services for course production and management (through CID)

(3) providing for formative evaluation of the telecourses

(4) developing a system of incentives and rewards.

In planning for distance education, the issue of rewards and incentives deserves attention. Faculty have been rightfully concerned about how telecourses would be treated with regard to teaching load, paychecks and credit toward tenure and promotion. Other concerns fit with what Dillon (1989) calls "academic credibility and personal rewards." An up front payment for development may be considered inadequate compared to the preparation involved. The issue of teaching load may be unclear. It is clear, however, that time spent developing a telecourse does not count toward tenure and promotion. This is restrictive for untenured faculty or for those with heavy research obligations. As for academic credibility, S.U. telecourse faculty are not now highly regarded, as they are in some universities. The personal rewards for teaching on television are intrinsic, unless the administration makes provisions for the extrinsic rewards.

Strategies to Increase the Acceptance of Distance Education

Perceived characteristics of innovations are often used in diffusion research to predict their rate of adoption. Rogers book, *Diffusion of Innovations* (1983) names five attributes of innovations that he has used to derive generalizations from studies of adoption: relative advantage, compatibility, complexity, trialability and observability. Each of these attributes, with the exception of complexity, is positively related to the rate of adoption. In this case, the way the attributes of distance education are perceived by the faculty or the administration is related to how quickly they will agree to become involved.

The "fits and starts" experienced in the adoption process for distance education at S.U. may be compared to Rogers' generalizations. Managers of distance education may be able to address the common problems related to perceived attributes of innovations. Therefore, by implementing strategies that address these problems, the manager may increase the acceptance (adoption) of the distance education program.

Relative Advantage

Rogers indicates that relative advantage, or the degree that the innovation is seen as being superior to previous practice, is one of the best predictors of successful adoption. Relative advantage for distance education could be viewed as status-giving, profitability or cost-effectiveness, an improvement in practice or various faculty incentives. This topic is worth a thorough examination. In this case, the manager's ability to promote the relative advantage of distance education is critical to its adoption and eventual success.

Status... In this case, having an uplink confers status upon S.U., putting us in the "big league," a major player in the telecourse arena of distance education for engineers. Faculty may also reap the benefits of an increase in status: they are more visible to the corporate client, and may be chosen for a special research assignment, consultation or conference. On the other hand, some faculty fear the increased visibility of television because it highlights their mistakes or inadequacies in presentation style.

Cost-effectiveness... Distance education certainly has the potential to be more cost-efficient and cost-effective than conventional education, depending upon how well the system is designed and managed (Rumble, 1987). Satellite time is very expensive. It is many downlinks and large enrollments that improve the profit margin. S.U. does not yet have this economy of scale. Even so, the satellite telecourses have been marginally profitable, and the taped video-courses very profitable according to recent estimates.

Improvement in Practice... There are many colleges that offer distance education programs as a part of their continuing education divisions, but part of the problem is that these programs are often considered to be academically inferior to conventional classroom instruction. Distance education is proven to be an effective method of delivering instruction (Clark and Verduin, Jr., 1989), although course development for a quality telecourse is not entirely simple. These are complex programs that represent a departure from conventional (classroom lectures with students present) types of education. The relative advantage here is gained when the faculty member sees this process as an opportunity to improve the course by obtaining professional assistance in areas such as design, graphics development and evaluation. The payoff comes when the professor has a set of professionally produced graphics ready (with minor modifications) for a conference or special lecture.

Incentives... Faculty incentives are critical for the perception of relative advantage. Strategic planning for distance education must address the issues of tenure and promotion, as mentioned above. One incentive here is the major savings in travel time, even though the professors will travel to each of the Centers during the semester, they do so less often. Time is critical for professors engaged in research activities.

Compatibility

According to Rogers, compatibility means that the innovation is a good fit with existing values, past expe-

riences and adopter needs. Issues of compatibility are especially relevant to distance education, given the general attitude of professors toward "unconventional" instruction, including instructional television. The development of the distance education program must be seen as compatible with the needs of the academic department. Here, academic administration must be vocal in demonstrating compatibility with department goals and existing values.

Complexity

Rogers' research shows that innovations perceived as complex are less likely to be adopted. Distance education is a complex process of development and management, especially for college instructors who are used to developing their courses on their own. The basic strategy is to make the development process as transparent as possible, while maintaining quality of the product at the same time.

Trialability and Observability

Rogers demonstrates that if an innovation can be tried before it is wholly implemented, and if people can observe how it works before making a commitment, the rate of adoption is faster. At S.U., we encourage the faculty member to try his/her ability in front of the camera for a trial run. Engineering faculty have many opportunities to observe distance education programs, both ours and theirs, through a downlink at their college. They can pass by the open door to the control room near the studio classroom and watch what is going on. Demonstrations set up by CID are another way to get faculty involved.

Summary

Within the next decade, distance education may play a major part in adult education and in the training of our workforce. Like other universities, Syracuse University could institutionalize and expand distance education to include additional degree offerings. To do this, the faculty and administration will have to have a positive experience with distance education. At S.U., the experience gained from working out the bugs with the College of Engineering should now make the process of adoption by other departments much easier.

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Further information on electrical and computer engineering telecourses may be obtained by completing and returning the coupon on the last page of the journal.

Job-Aids

*Alex Romiszowski**

MAP #1 STRUCTURAL COMMUNICATION: Overview

Introduction	*The technique of "Structural Communication" was invented and developed in Britain in the late 1960's and early 1970's. It was an attempt to apply Humanist philosophy and Cognitive psychology principles to the design and development of auto-instructional materials. It was both a reaction to and an extension of the largely behavioral-psychology-based "programmed instruction" that was popular at the time. Also, it was designed, from the beginning, as a technique for the generation of interactive, computer-based, "conversational" tutorials, although most of the early implementations were in fact printed as booklets. Given current advances in computer technology, hypermedia and interactive video systems, the possibilities for the use of such instructional designs is on the increase. Given the "state of the art" of computer-based-instruction design and its largely behavioral roots, it is high time that approaches such as structural communication become better known and more used.*
Intention	The principal intention, or goal of this article is: to explain the principles and the structure of "structural communication (S.C.)" study units; to give an example of an S.C. unit and to engage the reader in interactive study of this unit; to compare S.C. in action with other forms of auto-instructional materials; to compare S.C. with more conventional teaching approaches; to generate some categories of possible applications of S.C. in education and training and some guidelines for its use. A secondary intention is to indicate, in outline, the design and development process by which an S.C. unit is produced, and to indicate where further information on developing such units may be obtained. This will be developed in point 2 of this article, to appear in the next issue.
Definition of Structural Communication	Structural Communication is a technique for engaging a learner in a challenging, but game-like, problem-solving exercise. Although it may be used with precisely defined and highly structured subject content (e.g., Math), it is particularly (uniquely?) applicable to more open-ended subjects where many viewpoints and alternative solutions may be validly defended (e.g., history, management, etc.).
Examples of Applications:	1. The earliest application of the technique was in the "exact sciences (chemistry; physics; biology) and in mathematics, but to topics where it is important to investigate the structure of the knowledge-base (set theory; rings and fields; advanced optics and thermodynamics). 2. The technique was then extended to such subjects as history and art appreciation, where it was capable of modeling (and teaching to students) the thought processes of historical inquiry and inference, or aesthetic judgement and evaluation. 3. More recently, the technique has been applied in the development of interactive case-study exercises, simulations and guided discussions, in such topics as management decision making, systems analysis, literary criticism, instructional design and development, etc. Current projects at Syracuse University are investigating these types of applications.
Analogy	The student's activity in an S.C. exercise is somewhat like the outlining of an essay to address a complex multi-faceted problem. The system's feedback to the student is somewhat like that provided by a knowledgeable personal tutor who espouses the principles of "Socratic dialogue" in commenting and discussing the essay.

MAP #2 STRUCTURAL COMMUNICATION: Structure & Process

Introduction *The way that a structural communication exercise works is best understood by analyzing the 6 component parts of a typical study unit and the function of each.*

Component parts of an S.C. Unit	Description	Example/Use
1. Intention	The Intention is the opening statement, which defines what is to be studied, provides an overview, possibly an "advance organizer", and sometimes a rationale.	Map #1 serves as an example (albeit imperfect) of a statement of intention. Note the similarity to a statement of goals/aims and an overview in conventional modules.
2. Presentation	The Presentation is the material, experience, exercise, case study, etc. which supplies the essential facts and concepts of the domain being studied. This may be an existing text, a video, a case study, a simulation, or real-life experience, depending on the overall strategy of the exercise.	Maps 2 to 4 serve as a somewhat condensed presentation of the main principles, and procedures of the S.C. technique. These are edited-down versions of longer and more complete "presentations" of these topics (to be found in Egan (1976), Hodgson (1974 b), and Romiszowski (1986).
3. Investigation	The Investigation is a set of problems for solution, which are designed to present the "intellectual challenge" that is an essential part of the S.C. methodology. These problems are interrelated and are open-ended to allow multiple responses and viewpoints.	At the end of this article, I present a somewhat edited version of a "structural communication exercise on structural communication" (which first appeared in Egan 1976). The four related problems which you are to investigate, challenge you to form your own view of S.C.
4. Response Matrix	The Response "Matrix" is a randomized array of items which summarize key parts, concepts or principles from the knowledge base that is being used and studied in the exercise. Often it resembles a "key point summary" of the Presentation. The student composes a response (outlines an essay) by selecting any number of these items as a "best" response to a given problem.	The response matrix in the example at the end is an array of 24 statements of the form "S.C. permits...." You can select any combination of these to respond to each of the four problems in the investigation. There are millions of possible combinations, though a smaller number are "plausible." The same item may be used in more than one response.
5. Discussion	The Discussion has two parts: a DISCUSSION GUIDE and a set of DISCUSSION COMMENTS. The GUIDE is a set of IF-THEN rules, which "test" the student's response for omission or inclusion of certain significant items, or combinations of items. The COMMENTS are constructive statements which discuss in depth the rationale for including or excluding certain items.	The exercise presented at the end, has, for problem #1, a total of six testing rules (4 for certain omissions and 2 for certain inclusions). Each of these rules, if satisfied, generates a specific feedback comment. The student may be required to read several of the 6 comments. Note that some of the comments are long and are rich in extra content and insights.
6. Viewpoints	The final component of a typical S.C. unit is an outline of the author's, and other alternative viewpoints; this may review some aspects stated in the Intention, make explicit some biases or standpoints held dear by the author, draw attention to other views in the literature, etc.	In this condensed "simulation" of a full S.C. exercise, the article by Pusch and Slee, elsewhere in this journal issue, presents some other viewpoints on why S.C. is a significant contribution to the practice of interactive education, and what role it might play in future educational and training systems.

MAP #3 STRUCTURAL COMMUNICATION AND PROGRAMMED INSTRUCTION: A Comparison

Introduction *As the bulk of computer-assisted instruction being used and developed at the present time still continues to be heavily based on the programmed instruction traditions and techniques, it is useful to analyze how S.C. is similar to and different from the programmed instruction that we have all known. (Much of this analysis is based on Egan 1976.)*

Compare/Contrast Table	Programmed Instruction	Structural Communication
1. Individualization of Instruction	P.I. effectively individualizes the pace of learning and only sometimes to some extent (in multiple-choice "branching" sequences) the pathway that a student might follow to achieve a given objective. Hardly ever does P.I. allow variety in the objectives to be achieved, individuality in the discourse or in what should be considered a "correct" or "best" response.	S.C. goes much beyond this in terms of pathway and sequence. As there are millions of possible response combinations and hundreds of possible feedback-comment combinations for any one problem, it is rare for two students to have the same learning experience. Also, the outcomes of learning may vary, as the style allows for tutor/student disgreement.
2. Efficiency of the instructional process	The efficiency of P.I. lies in the rapid and uniform achievement of lower-level types of learning, such as memorization of facts, mastery of single concepts, absorption of the work of given scholars. Many consider that it may reduce learners' efficiency at critical thinking, etc.	S.C. goes beyond this, by demonstrating efficiency in higher-order cognitive learning (problem solving, judgment), in the adoption by learners of scholarly methods of work and in creative use of the facts, concepts, and principles of a discipline.
3. Control over the instructional process	Almost exclusively "system control." Control over outcomes by specifying single "correct" answers at each stage. Control over student success by diminishing the complexity of materials/exercises till all succeed. Control over the student through "conditioning."	System (author) control over the content/knowledge domain to be explored, but large amounts of "learner control" over the process and the outcomes of this exploration. Multiple acceptable responses. Open-ended feedback which is "constructive" rather than "corrective."
4. Levels of thinking	Promotes low-level processing/thinking: [Using Egan's 1976 4-level model] - "Automatic" (data absorption without understanding) or at best - "Sensitive" (data processing to create meaningful messages)	Promotes higher-level processing/thinking: - "Conscious" (information processing to generate new knowledge/understanding), or when well-authored - "Creative" ("knowledge processing" to generate new insights - "eureka")
5. Process of Learning	Almost exclusively through the RECEPTION of previously authored relationships and viewpoints. May ask for "rhetorical" criticism of these viewpoints, but implants them first in the mind, by EXPOSITIVE presentation. Intuitive/creative "leaps" by the learner are not encouraged and may indeed be inhibited by the excessively autocratic, system-controlled instructional process.	Encourages DISCOVERY of key relationships and structures, by setting learners an intellectual CHALLENGE in the problem sets and a SOCRATIC-like dialogue in the discussion. The challenges promote and the discussion encourages "COGNITIVE LEAPS" or "TRANSITIONS TO HIGHER LEVELS OF UNDERSTANDING" of a domain.
6. The ultimate outcomes	A "conditioned mind" that has learned to think not only linearly, but along the lines of the specific authors or scholars involved/quoted in the specific course.	A "deconditioned mind" in which concepts and facts are easily loosened from previous associations in order to form new ones. Non-linear thinking is encouraged.

Final Comment This comparison is intentionally drawn in a harsh light. It should not be taken, however, that P.I. is always "bad" and S.C. is always "good." It is a question of appropriate balance in education and training between the two approaches.

MAP #4

STRUCTURAL COMMUNICATION IN THE CLASSROOM: Proven and Potential Uses

Introduction	*Much conventional instruction, even lectures or classroom based lessons, are closer in structure, process and outcomes to the "programmed instruction" model than to the "structural communication" model. There are, however, some well known methodologies which break away from this norm. Examples are: the "guided discovery" lesson; case-study method; simulations and games; group discussions; self-analysis; etc. In this map, we show that the S.C. methodology can be adapted and used in most, if not all, of these contexts, and can often enhance the learning experience.*
S.C. as discovery learning	A typical S.C. study unit, as the one shown as an example at the end of this article, presents basic knowledge about the domain being studied, in the form of an EXPOSITIVE presentation. It is possible, however, to use just the interactive part of the model (INVESTIGATION, DISCUSSION, VIEWPOINTS) to discuss existing and create new understandings of a real-life experience or of currently held views, attitudes and cognitive schemata. In both the above cases, however, the investigation and discussion may contain an element of discovery of new relationships on the part of the learner. Discovery in a S.C. environment is more structured, guided and predictable than in most other discovery-learning situations.
S.C. as case-study method	One highly successful and growing use of the S.C. methodology is as a vehicle for the DISCUSSION of a case. The case materials form the presentation. Then the investigation and discussion follow the S.C. pattern. This approach has been used successfully to enhance learning from Harvard Case Studies (Hodgson and Dill 1971), from Interactive-video-based cases (Romiszowski, Grabowski and Pusch 1988) and from classroom-based, role/play and interactive situational cases (Romiszowski 1990). In all these situations, the S.C. method supplies an interactive but automated "debriefing" session that takes learning beyond the "facts of the case" to the underlying general principles and the overriding operational structures and processes.
S.C. as simulation-game	Egan (1976) makes the point that simulations may actually simulate a situation/environment/phenomenon and also an approach or a thought process. The case-study method extends to fully interactive situational simulations. The "discovery-learning" and "emulation of the scholar's critical thinking" aspects of S.C. are examples of simulating and practicing cognitive approaches to problems, that are valuable in real-life situations. Thus, the S.C. investigation/discussion method may be usefully incorporated in many so-called "experiential learning" methodologies.
S.C. as "reflection in action"	Another useful application is to take real problems from a job and create a matrix of real facts and events in the job situation, as instrumentation to encourage the sort of "reflection-in-action" learning process suggested by Schon (1983, 1987).
S.C. as group discussion	It is quite effective to "instrument" a small group discussion on a set of problems, by supplying a response matrix for the group to reach consensus by jointly picking a set of preferred response items. The group leader armed with a discussion guide and an outline or "blueprint" of the comments related to each critical response-pattern, leads the discussion "live", without the use of printed feedback comments. This approach is an exceptionally effective way of ensuring focus and depth in the discussion. It also has the advantage of allowing discussants to add their own non-matrix response elements, or to question, disagree with, or build further on, the planned discussion.
S.C. as an assessment method	It is possible to assess the quality and depth a student's understanding of the knowledge domain of an S.C. exercise either intuitively (as one often does with essay questions) or objectively, by assigning weightings to the items in the response matrix. This latter approach is of interest, because it is considerably more objective than the methods commonly used to assess open-ended essay-type exam questions, yet it does not have the mechanistic, low-discrimination power, lower-level-learning-oriented aspects of conventional multiple-choice testing procedures. This use of S.C. (as an assessment method) is worthy of further investigation. For a fuller discussion, see Egan 1976, chapter 4.

MAP #5 STRUCTURAL COMMUNICATION: A Practical Example

Introduction

We reproduce here an S.C. exercise, written by Kieran Egan, and first published at the end of his book "Structural Communication" (Egan, 1976). There are 4 problems in the set. We have presented the discussion comments only for the first of these problems. Working through this excerpt will give you a taste for the S.C. Methodology. If you wish to take the exercise further, please respond to the other 3 problems on the response-slip at the end of theexercise. You may also add any further comments you wish. We will mail you, by return, an analysis of your response and a further selection of discussion comments.

TREAT THIS AS AN OPEN-ENDED CORRESPONDENCE-COURSE EXERCISE. We will later write up our observations on the exercise and mail them to all those who chose to participate.

Problems

1. The heart of an S.C. unit is the challenge with which the student is faced, the challenge being to compose a sensible response to each problem by means of the items provided in the matrix. The period of composing the response has been called the "challenge-response interval," during which the student's intellectual activity is at its highest level. Use the Response Matrix to describe what is enabled to take place in this challenge-response interval because of the nature of S.C.

2. Little has been written in the Presentation about the theoretical background out of which S.C. has developed, or about the experimental work from which its present form emerged. Rather, the concentration has been on describing the technique and some of its uses, and arguing that it represents a particularly valuable contribution to the practice of education, both because of its contribution to the kind of intellectual activity it promotes, and the strategic advantages its design offers to the teacher. Concentrate in this problem on this latter contribution of S.C., on what advantages it offers to the teacher planning the organization of her classes. What features of the technique make a direct contribution to teaching strategies in the typical classroom?

3. Some of the features of S.C. have been described in the Presentation as advantages that the technique has over other methods in achieving particular ends, either on the grounds of economy or efficiency. For this problem, consider rather those features and uses of S.C. that are unique, that is, features that are not simply improvements on other techniques or methods but that represent a breakthrough to new capacities. Use the Response Matrix, then, to compose a picture of S.C.'s uniqueness.

4. The typical response to an S.C. Investigation Problem is a set of numbers corresponding to the student's thought about the issue within the constraints imposed by a limited matrix of items. What additional pedagogical advantages are made possible as a result of this kind of response?

Response Matrix

Structural Communication permits			
the diagnosis of subtle misunderstandings. 1	uses for both individual or group learning. 2	the objective measurement of sophisticated intellectual skills. 3	a number of functions to be performed by the same unit. 4
an economical method of providing high-quality learning. 5	the loosening or freeing of concepts from past associations. 6	taking the inquiry beyond the typical presentation of the subject matter. 7	the determining of future stages by the student's response. 8
the replication of the author's understanding. 9	a restricted simulation of scholarly activity. 10	the reinforcement or correction of understanding. 11	discriminating subthemes from a generally relevant semantic field. 12
the using of particular sections when required. 13	progressive clarification of meaning. 14	a variety of response strategies in a controllable medium. 15	engaging the student in a synthetic intellectual act. 16
the emergence of the structure of the theme in the process of communication. 17	an efficient method of communicating the richness of a theme. 18	the identification and discussion of a student's judgements and biases. 19	focusing and stimulating thought on the relevant material. 20
a self-contained teaching medium. 21	distinct yet interdependent sections to develop an unambiguous message. 22	an engaging game aspect. 23	a comparison with the author's understanding. 24

Discussion on Problem 1

in the charts below for: I : 3 and 7 --> A
O : 9 or 12 --> B

read:
If you included in your response both item 3 and item 7, read comment A below.
If you omitted from your response either item 9 or 12 read comment B below.

Problem 1: O: 6, 7, 9, 14, 16 or 17 --> A
O: any two or more of 10, 12 and 23 --> B
O: any two or more of 15, 18 and 20 --> C
O: 8 and 15 --> D
I: any two or more of 1, 11, 19 and 24 --> E
I: any two or more of 2, 3, 4, 5, 13, 21 and 22 --> F

Now continue with the next problems

Response Coupon

"Complete, clip, and communicate"

For each of the 4 problems on the facing page, respond by noting down the number of all the items in the response matrix above, which you would include in your "best argued" response to the author. You may include as many items as you wish in each response (but don't "overkill" just for the sake of it). Also, the same item may be used in response to more than one problem, if you think it fits. First respond to problem #1 and then check over comments on the following pages. Then respond to the other three problems, clip this coupon and mail it to us to receive further feedback and discussion.

Problem #1 My response includes items:

Problem #2 My response includes items:

Problem #3 My response includes items:

Problem #4 My response includes items:

Discussion Comments

A. It has been shown that the best way to teach a student a general concept, for instance "democracy," is not simply to repeat the characteristics of democracy until the student can produce them on demand, but rather to give a set of examples which indicate what the concept means in a variety of contexts: democracy in a club, in a school, in a church, among a group of friends, in a society, and so on. By this method the student will come to a quicker and more flexible understanding of the concept. I think the same principle is embodied in the challenge-response mechanism of S.C. but in a more general sense, enabling the efficient communication of complex concepts and sets of related concepts and facts. To achieve this more general comprehension, S.C. enables the author to engage the student in viewing concepts and facts in different sets of relationships. Indeed, in S.C. the student is engaged in composing these contexts for himself. To to this, it seems to me, he must synthesize the material rather as he does in developing a flexible understanding of "democracy." This kind of thinking, which allows the building up of new patterns of ideas and facts, seems to be of a level which allows also the breaking down of simpler patterns, enabling the "bits" to be utilized in the new stucture.

The ways the student composes his response in a typical study unit enables the author to bring together the principal features of his theme in a particularly efficient and concise manner, ensuring that, as the student makes his response, the structure that is central to the author's own understanding is recomposed, synthesized and, so, understood. The student may reject the new patterns of understanding, or insights, of course, but the first aim of the educator is to expose these new patterns to him.

If you have been directed to this comment I hope our disagreement is about the terms I use--which I readily agree are sometimes vague, often controversial, and unhappily jargon-heavy--rather than about the level of intellectual activity that the technique can reliably generate, or about what is made possible when one can focus this level of intellectual activity on the crucial recomposition of a relatively complex set of facts, concepts, judgments, etc. If you remain dubious about the latter, because of the opaqueness of my descriptions, I recommend that you work through a couple of study units in your area of interest, and reflect on what happens. If you still disagree after that, I guess we must simply agree to disagree for now.

B. The game-playing aspect of S.C. is certainly not utilized to the full in this example. I have tried rather to concentrate on uncovering sources of possible disagreement, hoping that I could count on your interest in the techniques to motivate you to respond. In the example of the Anglo-Saxon study units described in Chapter 6, the motivation to learn about Anglo-Saxon society could not be presumed, so the game-playing aspect was more prominent. Those units demand nice discriminations as students deal with problematic and varied information like practicing historians. The kind of game playing involved in simulating scholarly work at an appropriate level ensures that students generally find these units fun. I mention the Anglo-Saxons simply because those units exemplify most clearly the aspects of game playing while simulating a relatively greater or lesser extent in the way the student is challenged to respond in all well-constructed study units.

Perhaps you think that working through an S.C. study unit is a long way from a game, and a long way from simulating scholarly inqury. If we boxed up a set of study units and tried to sell them from the toy counter of a department store, we probably wouldn's do too well. But the idea of gaming has moved some way from that of children's games and simulation needn't be simulation at the level of the scholar's activity. Perhaps I'm trying to get a bit of mileage out of favorable associations, but I really don't think I'm either stretching the language or misrepresenting the potential of the technique.

RESPONSE COUPON - COMPLETE, CLIP AND COMMUNICATE

You should write down your response to all four problems (using the response-matrix) in the space provided on the reverse side of this coupon. Then clip the coupon and mail it to us in order to receive a further set of discussion comments. Don't forget to fill in the details below.

Your Name:

Address:

Here is a space for any other comments you may like to make, either on one or other of the four problems presented, or on the S.C. methodology in general.

C. You have been directed to this comment because you omitted a couple of general points that seem to me to contribute a fuller picture of what is entailed by responding to S.C. problems. The immediate focusing on relevant material and efficient contruction of a rich set of interrelated meanings, while still allowing the student considerable freedom of strategy (not just choice of items) in responding, outlines for me the advantages of S.C. as an effective individualized teaching medium. But these points are generally stated, and our disagreement may only be about some of the terms I have used. If it is more profound, I confess I find it difficult to provide any further arguments, and will simply refer to the description of how S.C. works and hope those characteristics will be seen as self-evident.

D. There is perhaps some ambiguity in the statement that the technique enables the determining of the future stages of the student's progress while he is in the process of composing his response. It is significant, I think, that the kinds of decisions the student is making in composing his response determines what kind of discussion he will later be engaged in. This relects another aspect of the interdependence of the sections of the technique, which allows control over the communication process while also allowing considerable freedom to the student in responding.

E. I think you have included some items that the technique enables to take place not in the process of responding but rather as a result of a particular response having been made. For example, it is not until this section that an opportunity arises for us to compare our understanding, even though the aim of the problems and matrix is often to get the student to replicate the author's understanding. Similarly, only after the response has been recorded can we move to correcting or reinforcing understanding, or discussing judgments and biases. Only at this point in the study unit can I attempt to correct you if you have included item 11. The problem asks what is enabled to take place in the challenge-response interval, not what can be done as a result of it.

F. If you've been directed to this comment, something is wrong somewhere. Perhaps the problem or matrix items are more ambiguous than they ought to be, or perhaps you've misread something. I would consider all the items leading to this comment to be more or less unrelated to the intellectual or technical processes to which the S.C. challenge-response interval gives rise. I suggest you reread the problem more carefully and interpret the items somewhat more rigorously.

* Alex Romiszowski is a Professor of Instructional Design, Development and Evaluation, and the Director of the Training Systems Institute at Syracuse University.

* * *

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This issue of Instructional Developments focuses on the adult learner, whether in higher or in continuing professional education.

In the opening article, Roger Hiemstra outlines the paradigm shift that has occurred in adult education, from the teacher-directed pedagogical approach modeled on conventional school practices, to a learner-directed "andragogical" approach that takes into consideration the previously acquired skills and experiences of adult learners, as well as their current and future professional needs. Romiszowski, Mulder and Pieters follow with an analysis of the case-study methodology and its particular applicability to adult continuing education. They focus on the design, development and utilization of case studies in the teaching of heuristic problem-solving strategies, using the teaching of instructional design and development skills as a case example. One aspect that is stressed is the design of the case discussion, or debriefing stage, which is critical to effective use of the methodology, but is generally left to the course instructors, or facilitators, to figure out for themselves. As the report on the World Conference on Case Method suggests, case-discussion facilitators require a range of skills that go beyond conventional teaching.

Mardy Eimers follows on with an analysis of the background and experiences of new university faculty, showing that in general they tend to be strong on subject expertise, but not so experienced as teachers. Every effort should be made to provide support and assistance in this respect early in the careers of new faculty. Charles Spuches describes an approach to providing such support and assistance, currently being implemented at SUNY-ESF. The instructional and faculty development effort described involves seminars on instruction, consulting, course and curriculum development projects, as well as direct attempts to impact the organization's culture.

Another approach to providing support and assistance to adult educators is by means of networking. In her report on Syracuse University's Kellogg Project, Mary Beth Hinton describes how modern computer and telecommunications technologies have been harnessed to permit international networking among adult educators, both by accessing distant databases and by exchanging information of mutual interest.

Instructional development may also extend to the selection or design and development of specific instructional materials. In her article, Karen Jost looks critically at the computer-based interactive video (CBIV) movement, in the context of past media research and current research on learner control. This aspect is particularly apt to adult education, in that the flexibility inherent in the CBIV medium may provide the levels of learner-directedness and individualization that Hiemstra suggests are important elements of an andragogic approach to adult education.

The job-aids section, this time, concludes the series on Structural Communication, which commenced in the previous issue, and continues on to describe procedures for the design and development of case materials and case-study exercises. These job-aids follow on from the article on the case method in suggesting how one might use the methodology in a distance-education mode, utilizing computer/telecommunications networks.

In this issue, we have not included a pre-printed response coupon to allow more space for the journal content. This should not be taken as a sign that we are discouraging feedback. Please write to the editor with your comments or queries on any of the articles. In particular, react to the job-aids. In the next issue, we shall devote space to feedback on the questions, exercises and issues contained in the last three job-aids sections. There is still time for you to contribute to this.

Several readers have inquired about subscription rates. For the time being, we continue to distribute Instructional Developments free of charge. Some have sent voluntary donations. We are thankful for these and encourage more of you to send us financial contributions in order to enable us to continue publication.

Moving From Pedagogy to Andragogy

*Roger Hiemstra**

There is little doubt that currently the most dominant form of instruction in Europe and America is pedagogy. Notions regarding pedagogy tend to undergird much of the thinking by educational theorists, administrators, instructional designers, and practitioners. A competing idea in terms of instructing adult learners, and one that has gathered momentum within the past two decades, has been dubbed andragogy. The purposes of this article are to provide some background information regarding both instructional forms, an assessment of the status of andragogy today, and a comprehensive bibliography related to andragogy for the interested reader desiring to pursue the topic in greater detail. An annotated version of the bibliography appears in Brockett and Hiemstra (in press).**

The pedagogical model of instruction was originally developed in the monastic schools of Europe in the Middle Ages. Young boys were received into the monasteries and taught by monks according to a system of instruction that required them to be obedient, faithful, and efficient servants of the church (Knowles, 1984). From this origin developed the tradition of pedagogy, which later spread to the secular schools of Europe and America and became and remains the dominant form of instruction throughout much of the world.

Pedagogy is derived from the Greek word paid, meaning child, plus agogos, meaning leading. Thus, pedagogy has been defined as the art and science of teaching children. In the pedagogical model, the teacher or even the instructional designer has full responsibility for making decisions about what will be learned, how it will be learned, when it will be learned, and if the material has been learned. Pedagogy, or teacher-directed instruction as it is commonly known, usually places the student in a submissive role requiring obedience to the teacher's instructions. Although the notion of teacher-directed instruction is somewhat an oversimplification of a complicated concept, it is based on the assumption accepted by many that learners need to know only what the teacher as content expert or specialist teaches them. The result is a teaching and learning situation that actively promotes dependency on the instructor (Knowles, 1984).

Up until very recently, the pedagogical model has been applied equally to the teaching of children and adults, and, in a sense, this is a contradiction in terms. The reason is that as adults mature, they become increasingly independent and responsible for their own actions. They are often motivated to learn by a sincere desire to solve immediate problems in their lives. Additionally, they have an increasing need to be self-directing. In many ways the pedagogical model does not account for such developmental changes on the part of adults, and thus produces tension, resentment, and resistance in individuals (Knowles, 1984). However, it must be noted that Knowles (1980) admits he has come to realize that there is not a clear dichotomous distinction between pedagogical and andragogical beliefs in that many teachers today, regardless of the age of their students, use various andragogical elements in their instructional activities.

Andragogy Popularized

The growth and development of andragogy as an alternative model of instruction has helped to improve the teaching of adults. But such improvement did not occur overnight. In fact, an important event took place nearly twenty years ago that affected the direction of adult education in North America and, to some extent, elsewhere as well. Andragogy as a system of ideas, concepts, and approaches to adult learning was introduced to adult educators by Malcolm Knowles (1968, 1970). His contributions to this system have been many (1975, 1980, 1984; Knowles & Associates, 1984), and have influenced the thinking of countless educators of adults. The dialogue, debate, and subsequent writings related to andragogy have been a healthy stimulant to some of the growth in the adult education field during the past twenty years.

The first use of the term "andragogy" to catch the widespread attention of adult educators was in 1968, when Knowles, then a professor of adult education at Boston University, used the term (then spelled "androgogy") in a journal article. In a 1970 book entitled The Modern Practice of Adult Education (a second edition was published in 1980), he noted that andragogy is derived from aner, meaning adult, and agogos. He defined the term as the art and science of helping adults learn. In that book he used as a subtitle, "Andragogy Versus Pedagogy." As noted above, his thinking had changed from those initial ideas in 1968 to the point that in the 1980 edition he used the subtitle "From Andragogy to Pedagogy" and suggested the following:

> andragogy is simply another model of assumptions about adult learners to be used alongside the pedagogical model of assumptions, thereby

> providing two alternative models for testing out the assumptions as to their 'fit' with particular situations. Furthermore, the models are probably most useful when seen not as dichotomous but rather as two ends of a spectrum, with a realistic assumption (about learners) in a given situation falling in between the two ends. (Knowles, 1980, p.43).

The andragogical model as conceived by Knowles is predicated on four basic assumptions about learners, all of which have some relationship to a learner's ability, need, and desire to take responsibility for learning:

1. Their self-concept moves from dependency to independency or self-directedness.
2. They accumulate a reservoir of experiences that can be used as a basis on which to build learning.
3. Their readiness to learn becomes increasingly associated with the developmental tasks of social roles.
4. Their time and curricular perspectives change from postponed to immediacy of application and from subject-centeredness to performance-centeredness (1980, pp. 44-45).

Based on these assumptions he developed a process for teaching adults that has become known as the andragogical model:

1. The establishment of a climate conducive to adult learning.
2. The creation of an organizational structure for participative planning.
3. The diagnosis of needs for learning.
4. The formulation of directions for learning (objectives).
5. The design of various learning activities.
6. The operation of the activities.
7. The rediagnosis of needs for learning (evaluation) (1980, p.59).

Andragogy as a concept, set of assumptions about adults, or instructional approach was actually not new to Knowles' popularization of the term. Anderson and Lindeman (1927) had first used the word in the United States via a published piece, although Stewart (1986a, 1986b) notes that Lindeman apparently even used the term as early as 1926. Brookfield (1984) suggests that Anderson and Lindeman drew upon the work of a German author of the 1920's, Eugene Rosenstock. However, Davenport and Davenport (1985c) assert that the word was first coined in 1833 by Kapp, a German teacher.

Several European countries, such as Hungary, Poland, and Yugoslavia, also had used the term and related concepts prior to 1968. Hungarian educators, for example, place teaching and learning within an overall system called "anthropogogy" (Savicevic, 1981). This system is subdivided into pedagogy (dealing with youth education) and andragogy (concerned with adult education). There is some variety, too, in the application of related terms. Some countries use adult pedagogy, one (the Soviet Union) uses the term auto-didactic among others to refer to adult education activities, and a few countries use andragology to refer to andragogical science (Knoll, 1981, p. 92).

Outside of North America there actually are two dominant viewpoints: one by which the theoretical framework of adult education is found in pedagogy or its branch, adult pedagogy . . . and the other by which the theoretical framework of adult education is found in andragogy as a relatively independent science that includes a whole system of andragogic disciplines (Savicevic, 1981, p. 88).

Knowles, in describing his particular version of andragogy, associated it with a variety of instructional suggestions. He, too, detailed roles of facilitation for instructors and talked about ways of helping learners maximize their learning abilities. His early work with andragogy and subsequent interpretation of the learning projects research by Tough (1978) and others led to a 1975 publication on self-directed learning where he provided a variety of inquiry projects and learning resources on the topic.

Knowles (1975) offered some reasons for his evolving scholarship in the area of self-directed learning. One immediate reason was the emerging evidence that people who take initiative in educational activities seem to learn more and learn things better than more passive individuals do.

He noted a second reason that self-directed learning appears "more in tune with our natural process of psychological development" (1975, p.14). Knowles observed that an essential aspect of the maturation process is the development of an ability to take increasing responsibility for life.

A third reason was the observation that the many evolving educational innovations (nontraditional programs, Open University, weekend colleges, etc.) throughout the world require that learners assume a heavy responsibility and initiative in their own learning.

Knowles also suggested a more long-term reason in terms of individual and collective survival:

> . . . it is tragic that we have not learned how to learn without being taught, and it is probably more important than all of the immediate reasons put together. Alvin Toffler calls this reason 'future

shock'. The simple truth is that we are entering into a strange new world in which rapid change will be the only stable characteristic. (1975, p. 15)

Andragogy as Theory

An ability to carry out self-directed learning long after the stimulation of some activity like a class or workshop is completed or long after association with a teacher or content specialist is so important for adults who must cope with the constant and rapid change Toffler and others describe. The instructional techniques that have evolved from the andragogical framework in the past decade or so are changing the way teachers and others work with adult learners.

However, andragogy, and thereby Knowles' writings have evoked considerable criticism and debate. The Adult Education Quarterly (formerly Adult Education), for example, has contained a number of articles during the past 18 years debating or critiquing aspects of andragogy. Some have said that it is not a theory, but Knowles speaks to this point as follows:

> A criticism that has been leveled against andragogy several times is that it is not a theory. My problem with this is that in the social science literature there appears to be little agreement as to the meaning of the word theory. *Webster's Ninth New Collegiate Dictionary* gives two definitions that apply to this kind of situation: (1) "The analysis of a set of facts in their relation to one another" and (2) "A belief, policy, or procedure proposed or followed as the basis of action." I believe that andragogy qualifies as a theory according to both definitions. However, I prefer to think of it as a model of assumptions about learning or a conceptual framework that serves as a basis for an emergent theory. It certainly has served its purpose as a stimulant for a growing body of theoretical thinking in our field, and I thoroughly applaud this use of it. (Knowles, 1989, p. 112)

Another criticism is that andragogical theory has not been tested empirically. In reality, there is a growing volume of related research, both quantitative and qualitative, reported in literature from around the world. Most of the qualitative and action research has generally supported or refined the theory. Many of the quantitative studies have been involved with developing some sort of instrumentation related to aspects of andragogy.

Perhaps the best demonstration that andragogy has substance is its widespread employment in teaching, training, designing, and learning endeavors. For example, Hiemstra and Sisco (1990) have developed a procedure for individualizing instructional activities through a facilitative process that builds on both andragogical and self-directed learning ideas. Many trainers in various organizational settings use andragogical concepts in their efforts (Daloisio & Firestone, 1983; Gelfand & Associates, 1975; Ingalls, 1973; Thorne & Marshall, 1985). Knowles and Associates (1984) describe numerous applications of andragogy in business, industry, government, universities, professional settings, religious settings, K-12 settings, and even remedial education.

Andragogy also can be used with scientific as well as behavioral content and with people of all ages. The concept does not appear to be culture bound, either. Knowles and Associates (1984) report that it "has been successfully applied in North America, Europe, Africa, Brazil, and Australia with individuals from every socioeconomic level" (p. 417). Hiemstra (1987) observed successful implementation of andragogical concepts with rural villagers in Tanzania. Knowles and Associates (1984) suggest that several ideas have emerged from this research and from the use of andragogical principles by various people over many years:

1. The andragogical model is a flexible system of elements that can be adopted in whole or in part for a variety of settings.
2. Appropriate starting points and strategies for applying andragogical concepts are situationally-bound. In other words, not all elements must be employed every time for there to be success.
3. Learners normally will participate more responsibly and enthusiastically in an andragogical setting if they have some preparatory orientation to notions about adults as self-directed learners.
4. Learners normally will experience some anxiety when exposed to new educational approaches until they have had some experience with it.
5. Because many educators know only the pedagogical model, they will require training to understand how they might employ andragogical principles.
6. Many institutions have policies, rules, and regulations that will inhibit the employment of various andragogical elements and they may need to be changed or adapted.

The number of adults seeking continuing education opportunities or involved in some training experience will continue to increase over time. Thus, it seems imperative that educational researchers and practitioners constantly work to ensure that such involvement is successful. The andragogical model provides an important framework from which such instructional development can spring.

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** The narrative in this article is adapted from Hiemstra and Sisco (1990).

SYRACUSE FACULTY PRESENCE IN INDONESIA

Syracuse University participated this summer in a wide variety of Indonesian academic events. In several instances, multiple member teams offered workshops and symposia for higher education faculty and administrators. Individual SU faculty frequently trained with Indonesian faculty counterparts, and also presented short courses, workshops and symposia. Several of these were designed primarily for government and corporate managers responsible for training and human resource development.

Sponsored primarily by the Indonesian Open University and the Inter-University Center for Improvement and Development of Instructional Activities (IUC-IDIA), sessions and courses were often jointly hosted by other private and public institutions of higher education as well as such centers as the Indonesian Banking Development Institute.

Robert Diamond, Peter Gray and Alton Roberts from the Center for Instructional Development and Ron Cavanaugh, Vice President for Undergraduate Studies, served as a team presenting examples of the Syracuse approach to organizational change, institutional improvement, faculty development and comprehensive evaluation.

Robert Bogdan conducted a workshop on *Qualitative Research Methods,* Phil Doughty on a) workshops on *Needs Assessment and Cost Effectiveness in Training,* and b) seminar on *Human Resource Development Functions,* Paul Pedersen on *Evaluation of Training Programs* used by the Peoples Bank of Indonesia for the Harvard Institute for International Development, and Alex Romiszowski on *Educational Technology Applied to the Planning of Training.*

The Case-Study Methodology and Instructional Development*

*Alex Romiszowski, Martin Mulder, and Jules Pieters***

This study examines the relationship between the case-study methodology and instructional development from two viewpoints:

a) Case studies on/about the Instructional Development (I.D.) process—to what extent is the case-study methodology appropriate for the teaching of instructional development/design.
b) The Instructional Development/Design processes that are appropriate/useful for the production of case-study materials/exercises.

In the first part, we examine some of the theoretical justifications for the use of case studies in education and training, identifying aspects of the I.D. process that may be good candidates for teaching by means of this methodology.

In the second part, we examine some specific approaches to the design, development and use of the case-study methodology, illustrating these with examples related to aspects of the I.D. process.

Case studies on/about Instructional Development

1. Characteristics of the Case-Study Method

The case-study methodology is, in its essentials, the presentation of information about a situation or a process-in-action, for analysis and discussion by a student, or (more frequently), by a group. In general, the case presented is expected to act as an example situation, from which something of more general applicability can be learned.

As a methodology of instruction, the case study offers many potential advantages. Significant among these are: the pooling of the experience of a group of students; the promotion of the process of synthesis of several concepts and principles into one multi-faceted explanation or plan of action (strategy); the promotion of a problem-solving-based learning situation that is a close simulation of the real-life situation from which the case data is extracted. Several other potential advantages are listed by Eitington (1984). These include: personal involvement; group cooperation; relationship to a known situation; recognition of different personal viewpoints; realization that there is not always one unique solution to a problem; improved interpersonal skills; improved communications skills; attitude change.

There are also some difficulties and disadvantages in the use of the case-study methodology. Notable among these is that it is very time-consuming as compared to more direct, expositive teaching methods. Another is that the ultimate objective, of developing a generalizable skill and ability to apply it across a wide range of real cases, requires more than just exposure to and discussion of the specific case. It also requires the participants to engage in deep-processing of the general principles involved, through a process of reflection and abstraction. The promotion and control of this process in turn requires special skills and expert knowledge on the part of the session leader. Other potential disadvantages identified by Eitington (1984) are: simulation of the decision-making process is incomplete; the stresses and constraints of reality are missing; the process is incompatible with some learning styles; it overstresses the need for a solution.

There are many variations of the case-study methodology. The best known (or "classic") one is referred to as the "Harvard" case method (McNair, 1954; Glover, 1947/73). This involves the presentation of a very detailed "dossier" of information about a case for group discussion and problem-solving. A characteristic of the method is that there is no one correct solution. Many possible avenues may be explored. The session leader is supposed to act as facilitator of the discussion, but should avoid forcing it in a given direction. Other variations of the case study method include: short, one-incident cases; the "mousetrap" technique; multiple-case techniques; audiovisual/mediated presentations of case situations to supplement/substitute printed case-histories; live, acted-out case situations. These and others are further described and illustrated in Eitington (1984).

The case-study methodology can be seen as one group of techniques that attempt to use "reality" as the context

for learning, but reality in a simplified/packaged/simulated form. Percival and Ellington (1980) suggest that the case study is related to other reality-based methods, such as role-play, simulations and games. An analysis of the various examples described by Eitington illustrates that sometimes it is difficult to draw exact boundaries between case studies, role-plays and simulations.

2. Case-Study Methodology Applied to the Teaching of Instructional Development

The nature of the Instructional Development process is such that reality-based, problem-solving-based methodologies of instruction would seem to be particularly appropriate to its teaching. The case-study method should be of great value whether part of a basically expositive or experiential strategy.

In an experiential strategy, the case would be studied at the beginning, and the general principles of I.D. would be "generated" by the course participants in subsequent reflective discussions, led but not dominated by the session leader/facilitator. This process is referred to by some authors (e.g. Schon, 1987) as "coaching the reflective practitioner."

In an expositive strategy, the principles of I.D. would be presented, perhaps by means of assigned readings, and would be illustrated by means of example cases of their application. Further cases would then be used as practice exercises in the application of the previously presented principles. This is the approach currently being used by the present authors in the courses they teach and in the structure of a forthcoming textbook based on the case-study methodology (Romiszowski, Mulder and Pieters, in press).

We shall return to the consideration of the design and development of such case-study materials later on. For the time being, we are concerned with the use of such materials and methods as part of one's overall approach to the teaching of instructional development.

Eitington (1984) states that the case study alone can be a very academic exercise. He suggests that, to ensure greater involvement, the method should be used with other techniques (group work, role-plays, fishbowls, brainstorming, etc.) We would stress, particularly, the need for expert debriefing of all these activities to ensure that the participants progress from considering the specific case to reflecting on the general principles that are at play and to considering how they would be relevant to other situations.

In an experiential (or "guided discovery") lesson, the debriefing process is of paramount importance, as it is in this phase that the instructor, by means of questioning and prompting, helps the students to reflect on the events and data of the case in question, in order to generalize the cause-effect relationships observed, generate (discover) principles or concepts and build (schematize) new theories or strategies applicable to further similar cases/real-life situations.

In an expositive instructional sequence, much (if not all) of the relevant knowledge base (concepts, principles, theories, and strategies) is presented "up-front" either by the instructor or by means of instructional materials. This first phase will, ideally, incorporate exercises and corrective feedback at the "understanding" level of Bloom's taxonomy (Bloom et. al. 1956). In I.D., we are almost always involved in heuristic problem-solving situations, the instructional plan then proceeds to the presentation of case examples that closely resemble the real-life problems that may be encountered in the future. This provides opportunities for the evaluation of learning at the "application" level of the taxonomy.

There remains, however, the question of "transfer of learning" to a wider range of possible real-life situations and the development of competence at the "analysis, synthesis and evaluation" levels. In a formal course on Instructional Development, there is a limit to the number of different cases that can be studied or projects that can be attempted. Therefore, a debriefing phase that causes the students to reflect on the more general implications of the cases studied is also a desirable part of an expositive strategy. In this phase, the student should be helped to form a cognitive schema, which links the earlier presented theoretical knowledge base to another that represents "practical reality."

It appears, therefore, that there are three important aspects to the case-study method: the facts of the case and their relation to a broader reality; the methodology of integrating the case study into the overall instructional plan; the final debriefing discussion and the depth of reflection that it promotes.

The Design and Development of Case Studies

1. The Design/Development of Case Materials/Descriptions

Traditionally, (e.g. Andrews, 1953) guidelines for the development process are restricted to the design of the initial "stimulus" case materials and to some guidelines for the instructor/facilitator on how to lead the session and exploit the materials effectively. There may be some "questions to guide participant's thinking about the problem presented" (Boyd, 1980). Less frequently, a plan is provided to guide the instructor in conducting the debriefing process (Van Ments, 1983).

There are two typical approaches to the design of case materials. The first proceeds from the principles (theory base) you wish to point up, to the selection or design of a situation (practice base) that demonstrates the "theory-in-action" (Boyd, 1980). The second proceeds from the identification of a problem area in "reality," which requires attention (this gives us our case), to the analysis of the case in order to identify the principles/concepts/theories which help to explain or solve the situation (that is, from the "practice base" to the "theory base" (Romiszowski, 1988). Both approaches then proceed to the design of the case structure and the development of the materials.

2. The Design of an Appropriate Case-Study Methodology

Once the case description is developed, one may wish to plan and (possibly) instrument the case-study session. Eitington (1984) suggests several useful ideas and approaches. However, he does not distinguish, as we do, between questions that focus on the facts of the case and questions that focus on the theoretical/conceptual structure on which the facts of the case can be hung. These are, in our view, two distinct stages (case-analysis and reflection-for-transfer) that should both be the subject of specific design/development effort. The first of these may be part of the case's instrumentation. The second is the debriefing plan.

Let us concentrate here on the instrumentation of the "case-analysis" phase. This may be in the form of an "instructor's guide" of questions to explore with the group, or may be written out for students' to analyse what type of final decision/action/solution is called for. A third possible approach is yet more rigorously "programmed" in that the final "findings" or "recommendations" are prompted/facilitated by first addressing a sequence of subsidiary or "lead-in" questions. In one application (Romiszowski, 1986), this sequence of questions follows a particular theoretical model/procedure for "performance problem analysis" (Mager and Pipe, 1970). When using this case study as part of an experiential learning lesson, the students are later encouraged to discover the general form of this model and to reflect on the general applicability of the model across a wide range of job-performance-deficiency problems.

In contrast, an expositive approach to the teaching of the same "performance-problem-analysis" skills, also used by the authors (Romiszowski, Mulder and Pieters, in press), is based on the assigning of basic readings and "worked" case examples as initial study material. This is followed by an "interactive case study" reading assignment, developed and instrumented according to the "Structural Communication" methodology (Hodgson, 1974; Romiszowski, 1986). This assignment includes its own multi-faceted evaluation of the individual student's thinking on the case problem presented and a complex "debriefing feedback" protocol. Only after this assignment is completed does further group-based work seek to establish transfer to other case contexts and lead the students to take "reflection-in-action" to get greater depth of generality.

3. The Design of a Debriefing Methodology

We have already discussed the importance of debriefing in both experiential and expositive applications of the case-study method.

The danger of overlooking, or skimping, the debriefing stage was dramatically illustrated by some research performed on the effectiveness of "DECISION POINT," a commercially available interactive-video simulation-game (described by the developer, Digital Equipment Corporation, as a "Living Case Study"). It has long been demonstrated that the presentation of case materials in film or video may often be beneficial (Green and Cotler, 1973). In particular, this has been found to enhance the acceptability of the case, its realism and the affective involvement of the participants in the exercise. When the interactive dialogue possibilities of modern computer-controlled interactive video are added, one could expect an exceptionally motivating and effective instructional product.

However, evaluative research showed that the product was indeed strong on motivation, but weak on the teaching of the general principles of management that were involved. This weakness was demonstrated to be correctable by the addition of a de-briefing session that took the participant to the appropriate level of abstract reflection on the concrete facts of the case (Romiszowski, Grabowski and Damodaran, 1988). Furthermore, this debriefing could be designed for interactive computer-based, delivery, rather than requiring group-based discussion with a skilled and knowledgeable facilitator (Romiszowski, Grabowski and Pusch, 1988).

The instructional design approach used in this automated debriefing exercise was "Structural Communication," a methodology that had earlier proved itself effective for the automated discussion, at a distance, of "Harvard" case-study materials (Hodgson and Dills, 1971). In current work, the Structural Communication methodology is being further extended as a basis for the design of case analysis and debriefing materials.

Conclusion: A Paradigm Shift?

The progressive stages of debriefing attempt to lead the participant(s) into ever deeper and wider-ranging reflection on the generality and limits of applicability of the principles illustrated by the case. The philosophy

behind the design of the debriefing discussions is similar to Schon's (1983, 1987) approach to "educating the reflective practitioner," One difference is that the reflection is instigated by selected cases, rather than the actual problems and events encountered in the course of real (professional) life.

Boxer (1985) argues that this distinction is of great importance, in that prepared case studies encourage the "revelatory" teaching paradigm when used in an experiential manner and the "instructional" teaching paradigm when used as part of an expositive strategy. He considers both these paradigms to be inferior to a fully reality-based approach, involving "reflective analysis" and encouraging what he calls the "conjectural" teaching paradigm.

Our reply is that for certain professions (for example doctors, consultants and indeed instructional developers), the professional reality is the analysis and solution of an ever changing range of cases. Case study is so close to reality as to make no difference. Furthermore, the Structural Communication method of debriefing a case investigation, coupled to the endorsements described above, promote, in our view, a form of reflective analysis not much different from the one advocated by Boxer. Thus, aspects of the "conjectural" teaching paradigm may be embedded into either the "revelatory" or "instructional" paradigms, rendering these distinctions somewhat fuzzy.

The fact that such reflective analysis and open conjecture can be promoted effectively by a methodology that is in large part pre-designed, pre-packaged and capable of replication, or delivery over distance, is also significant. Do we continue to call such systems "instructional systems," thus extending our concept of "instruction" way beyond the meaning ascribed to it by Boxer? Or do we look for a different name?

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THE CONFERENCE IN THE NETHERLANDS FOCUSES ON PROBLEM SOLVING WITH CASES - AND ITS RELATIONSHIP TO SIMULATION IN A TEACHING-LEARNING ENVIRONMENT

The Seventh International Conference on Case Method Research and Case Method Application, organized annually by the World Association for Case Method Research and Application (WACRA), was co-sponsored this year by the European Network for System Simulation and Management Gaming and held in Enschede, The Netherlands, at the University of Twente, April 9-11. The program was made up of some 60 presentations, including 6 invited keynote lectures, 34 formal papers, and 20 symposia, workshops, demonstrations and poster presentations. The emphasis was very much on the educational uses of the case method either by itself or as part of simulations and games. The majority of these papers discuss the implementation and use of the case method in education or training. They will be available in book form from Hans Klein of WACRA.

Among the invited papers, Klaus Breuer from Paderborn, Germany, presented a cogent analysis of the design principles that are typically applied in many educational simulations, games and case studies. Concentrating principally on computer based exercises, he demonstrated the preponderance of behavioral principles underlying most available examples. He then argued that a cognitive psychology basis was more in line with the aims and the philosophy of educational simulation and gaming. He outlined a theoretical framework derived from cognitive psychology literature and listed guidelines for the design of related conditions for learning, presenting some evaluation studies to support the practical effectiveness of the approach.

A significant number of participants addressed the use of instructional technology in the design and development of case materials and utilization systems. Some also discussed the design of cases specifically for the training of teachers and instructional designers. Sean O'Connor, from Washington College, Chestertown, USA, described the design and use of simple simulations and case studies for the training and development of teachers in such areas as: problem-solving capacity; ability to adopt alternative viewpoints and perspectives on an issue; and self-esteem. Still closer to instructional technology, Feteris, Martens and Terlouw described the development, experimental application and evaluation of cases designed to promote the learning of instructional design problem solving skills. These case studies have been designed at the University of Twente and have been experimentally implemented in the university's educational technology program over the last two years. The case design methodology used has been the subject of several research projects.

Alex Romiszowski, from Syracuse University, provided the first day's keynote address, which also had a strong instructional design flavor. This presentation focused on "The Case Study Method, Interactive Media and Instructional Design Theory." The main theme of this presentation was that the coming information age will require ever more people to exercise in their daily work a high level of problem solving skills, evaluation and judgement - exactly the types of skilled activity which are particularly well developed by means of case study and simulation methods. On the other hand, the opportunities to engage in group instruction will diminish due to the shifting economics of conventional versus distance education. Therefore it is particularly important to research appropriate methodologies for the development of case study experiences that can effectively be utilized on an individual basis or at a distance.

Examples of case materials employing the structural communication methodology were demonstrated. These were applications to the development of key instructional design and development skills, such as front-end analysis (see the example in the Job-Aids section), course and curriculum planning and lesson design. Many of these cases, as well as those being developed at Twente university, are to appear in a book devoted to "Case Studies in Instructional Development" (Romiszowski, Mulder and Pieters, in press, Kogan Page, London).

There were also several papers that addressed the question of effective utilization of the case method in a more general sense. The most powerful one of these was the invited keynote presentation of Louis Barnes of Harvard University, who addressed, in great depth and with great passion, the question of case method leadership. He commenced by outlining the "case materials crafting process," that is, the skills and procedures of case writing. While this is important, the subsequent "case discussion becomes our major process vehicle for shared learning and deeper inquiry, led by one who 'knows' some things about the case and the class - but not everything."

While acknowledging the point made in Romiszowski's presentation, that skilled case discussion leaders are in short and ever diminishing supply (in relation to growing demand), Barnes preferred to seek the solution in the development of more and better leaders, rather than in the application of instructional design and interactive media to the task of substitution or technological support of the case leader. He sees the case method as very strongly dependent on the instructor/leader, who should be: "both expert and ignorant amateur; problem seeking more than problem solving; complicating in order to simplify; leading while following; placing high value on both individual learning and collective learning; demonstrating both high standards of discipline and sincere empathy; combining equal emphases on analysis, diagnosis and action."

That certainly is an extensive list of skills and virtues. It is no wonder that exemplary case discussion leaders are hard to come by. However, that is one more reason for the development of tools that might support the case discussion leaders we do have, rendering them more accessible to more students. The distance-education case method is one approach to achieve this.

Background and Experiences of New Faculty

Mardy T. Eimers *

Introduction

In the past several years there has been a growing interest in the experiences of new faculty members. By "new faculty" we mean individuals who have secured a full-time, tenure-track appointment for the first time at a college or university. Most of the research reported in this writing assumes that the new faculty member has just received his/her PhD or will receive it in the first few semesters of employment. Likewise, this review focuses primarily on new faculty at four-year colleges.

The review highlights some of the key findings concerning the background and first year experience of new faculty.

I. The Background Characteristics of New Faculty

An individual's decision to enter academia has been explored by a number of scholars. Finkelstein (1984) reported potential explanations of how individuals enter the professoriate: 1) the decision to enter the professoriate comes after graduating from college as individuals realize that they have an intrinsic interest in conducting research and/or teaching, 2) the decision was stimulated by an influential undergraduate professor or mentor, or 3) the decision to enter the professoriate was not "consciously" made at all; the individual "drifted" into the academic profession.

With the exception of two-year institutions most colleges and universities desire to hire new faculty with the terminal degree. Katz and Hartnett (1976) reported that the focus of the specific graduate programs may affect the type of institution the PhD recipient seeks and the level of preparation the recruit has mastered to tackle certain first-year responsibilities. For instance, Katz and Hartnett (1976) shared a study conducted by the Graduate Record Examination (GRE) Board that determined what the deans of graduate schools in specific disciplines would rank as their school's primary purpose. According to the report, those deans of the Physical and Biological Sciences tended to center more on preparing researchers. In the Social Sciences and especially in the Humanities, the purpose focused more on preparing college teachers. (Practice was identified in each discipline as the lowest ranked objective.)

In addition, the study revealed that the prestige of the graduate program may have some influence on how prepared new faculty are to meet first-year responsibilities. The GRE study concluded that, principally, those PhD recipients who attended private and/or highly ranked graduate programs tended to concentrate more on scholarship and research, and those who attended lower ranked graduate programs were acclimated more toward the virtues of instruction.

Whether the primary purpose of a given graduate program focuses on developing teachers or researchers, or both, the significance of this purpose surely has an influential and enduring impact on graduate students and how they perceive their future role as a professor. The culture of graduate school often reinforces and encourages the merits of scholarship in contrast to instruction. As Katz and Hartnett (1976) explained, the socializing power during graduate school is significant:

> For whatever reason and with whatever background students have, the experience of graduate school has a conditioning power that hardly anyone could anticipate.

Most new faculty have received direct training in their discipline but have never learned how to teach. Edgerton (1988) illuminated:

> Faculty members come to us strong in content and blissfully ignorant of anything having to do with theories of learning and strategies of teaching rooted in pedagogical knowledge. In their knowledge of their disciplines ...they stand on the shoulders of giants; in their knowledge of teaching, they stand on the ground.

Clearly, the primary focus of graduate programs (regardless of the specific discipline and perceived quality of the graduate program) is to develop research scholars in contrast to educators. And although there may be different emphases at different graduate programs, a review of any graduate curriculum reveals courses in the discipline and courses in research skills, methods, and application. There are few if any courses in college teaching and student learning. When programs purport to be developing college teachers, potential faculty

members serve as teaching assistants or these programs assume that knowledge in a specific discipline qualifies one to be an effective instructor. Nonetheless, it is not *formal preparation* for the teaching role.

PhD recipients seldom procure their first position at an institution/department that is ranked higher in quality than the institution/department from which they received their PhD (Caplow & Mc Gee, 1958). At best, PhD recipients find a position at a comparable institution, and more than likely they accept an appointment at a less prestigious college or university. Wilson (1942) contended that although PhD recipients usually obtain their first faculty appointment at an institution lower on the "ladder of prestige," it is seldom significantly lower. This finding, though, is probably less relevant in the past two decades as the supply of PhDs, especially in some disciplines, has increased beyond the demand (Muffo & Robinson, 1981). Many PhD recipients were "forced" to accept employment at institutions lower on the "ladder of prestige" than past trends would have anticipated.

What criteria do selection committees use to determine new faculty members? Fink and Morgan (1976) investigated this question by surveying the chairperson and two colleagues of a given geography department at several types of institutions, (the chairperson and two colleagues representing an "artificial selection committee"). The authors explained, "Teaching was given more weight than research in all categories of departments and institutions, even in the large graduate-oriented institutions." Fink (1984a) hypothesized that these results may be reflective of the common belief that teaching qualifications are most important for the first appointment but that publication and scholarly productivity are most important for promotion, tenure, and job changes among institutions (especially a job change to a more prestigious institution). Caplow and Mc Gee (1958) elaborated:

> The radical ambiguity of a profession in which one is hired for one purpose, expected to carry out another, and prized for achieving a third: Teaching, research, and prestige are independent variables, besides being incommensurable per se.

If teaching is indeed the most important criterion for first-year appointment, then how do selection committees assess the teaching skills of new faculty? Again, referring to the Fink (1984a) study, he reported:

> Knowledge that the candidate had been a teaching assistant was the single most available and useful type of information. ...almost half of the candidates had not given a visiting lecture to the department before they were appointed.

II. The Common Experiences of First-year Faculty

Most institutions have at least some form of new faculty orientation at the institutional level and/or at the department level. These programs primarily focus on orienting new faculty to the procedures, traditions, expectations, culture and mission of the institution, and in some cases, of the department or college. Some orientation programs have extended their format to include training in teaching and/or research skills. Fink (1984a), however, found that new faculty are usually so busy that this type of training is often not implemented by new faculty during the first year.

Other researchers have concluded that faculty workshops and orientation programs may not be as effective as what is often hoped. These investigators draw their conclusions based on the premise that most frustrations are believed by faculty to be beyond a faculty member's direct control and difficult or unlikely to change (Geis & Smith, 1979, 1980). Shaeffer, Mc Gill, & Menges (1989) reported that teaching assistants held similar perceptions. These frustrations would seem especially acute for new faculty.

The background experiences and characteristics of a new faculty member undoubtedly influence the first few semesters of full-time appointment. Fink (1984b) hypothesized that new faculty members identify with either their graduate school experience or with their undergraduate experience. For instance, if the new professor identifies *primarily* with his/her undergraduate experience and the values espoused by this experience (regardless of the graduate school influence), then it is highly probable that this faculty member will find satisfaction forthcoming at a liberal arts undergraduate institution. The opposite, presumably, would also hold true.

One theme continued to appear in nearly all studies done on new faculty: new faculty are extremely busy (Boice & Turner, 1989; Mc Keachie, 1986; Fink, 1984b; Sorcinelli, 1988; among others). Boice and Turner (1989) elaborated:

> The overwhelming majority (83%) of these new faculty reported a level of "busyness" which resulted in stress-related symptoms (e.g., sleep disturbances, anxiety attacks, frequent and salient mood shifts, etc.). Approximately a third of the sample claimed to be the busiest they've ever been in their lives and 73% reported their perceived level of busyness to be a source of significant personal stress.

Similarly, Sorcinelli (1988) summarized the impact that this busyness can have on new faculty's personal life:

> Most new faculty concur that during the first year it is hard to find room for a life outside of work. ... New faculty were frustrated by lack of opportunities to meet other new faculty, and by the lack of time to exercise, to go to the opera, to establish friendships, to attend to family.

What factors might contribute to this busyness and accompanying levels of stress? Atelsek and Gomberg (1978) found that only 52.9% of new faculty in 1976-77 "had either received the (doctorate) degree *or were expected to within the next year.*"

Probably the most significant factor determining the "busyness" of new faculty is the responsibilities that accompany teaching. Sorcinelli (1988) reported that for the majority of new faculty, the biggest problem was the adjustment to teaching. Fink (1984b) hypothesized that there are primarily three factors that determine the overall effort expended by new faculty: 1) the nature of the teaching load, 2) the type of institution, and 3) the level of experience the new faculty member has prior to accepting the position. Fink (1984b) described the importance of the teaching load:

> The most disturbing aspect ... in this respect is that more than 50 percent of the new college teachers in every type of institution had four or more separate courses to prepare and teach during their first year. ... Apparently, it is not the number of classroom hours itself that creates problems for new teachers but rather the number of class preparations and the number of students involved.

Boice and Turner (1989) reported that new faculty in their study averaged five courses and three new preparations in the first year; Sorcinelli (1988) reported four new preparations per new faculty. The Boice and Turner (1989) and Sorcinelli (1988) studies were both conducted at large research universities.

Much of the busyness and resulting stress from teaching probably comes from the lack of experience and training new faculty have in instruction, and this leads to feelings of incompetence and insecurity which are reflected in their teaching. But whatever the specific causes, Boice and Turner (1987) labeled the symptoms of the new faculty member as "assistant professoritis," that is:

> ... new faculty overprepare, feel compelled to teach everything they know, provide little time or incentive for student participation, impress students as aloof and unapproachable, receive poor student evaluations, and blame this outcome on the poor quality of students in their classroom.

These negative first-year teaching experiences can permanently taint the forthcoming career of new faculty. Mc Keachie (1986) reinforced this possibility:

> Experiences during this period (the first teaching experience) can blight a promising teaching career or can start one on a path of continued growth and development. ... One likely response of the teacher is retreat — retreat to reading lectures with as little eye contact with students as possible — retreat to threats of low grades as a motivating device — retreat to research and other aspects of the professional role.

The demands of teaching also affect the research productivity of new professors. Boice and Turner (1989) revealed that new faculty fully expected to spend 50% of their time in this quest during the first year. Unfortunately, new faculty fell well short of their own expectations. The authors reported that, on the average, faculty only spent about 15% of their time engaged in scholarly pursuits. Much of this they blamed on their own procrastination — even though research was a high priority — as new faculty found it difficult to procure the time or the motivation to write. In addition, Boice and Turner (1989) reported that their interviews revealed that teaching responsibilities were most often cited as the primary cause of a new faculty member's modest research productivity.

Several investigators have reported that new faculty express feelings of incompetence, loneliness, and alienation that often lead to dissatisfaction. Sorcinelli (1988), identifying a primary cause of this dissatisfaction, stated that "new faculty reported lack of collegial relations as the most surprising and disappointing aspect of their first year" and that "political divisions within departments were particularly stressful for new faculty." Boice and Turner (1989) concurred:

> Relationships with colleagues were the most salient and pervasive source of dissatisfaction among all subsamples of new faculty. ... Few faculty reported the support, stimulating conversations, mentors, collaborators, and friends they had hoped for.

In addition, the authors reported that senior faculty seemed especially distant, the overall quality of collegial relations in their departments was "poor" or "fair," and "the level of intellectual stimulation and companionship they experienced was inadequate to their needs." Other investigators have described similar scenarios with teaching assistants (Peverly & Centra 1990; Stanton & Darling 1988).

Nonetheless, some of the "blame" may rest on new faculty members themselves. Boice and Turner (1987) explicated:

> Despite their expressed desire for collegial interaction, new faculty in their first year were not themselves proactive in this regard. They rarely initiated informal professional interaction with colleagues and rarely sought advice or mentoring from senior colleagues.

Department chairs also influenced the experience of new professors. In most cases, department chairs were a significant and positive influence on new faculty (Sorcinelli, 1988). In fact, in the Boice and Turner (1989) study, the authors reported that new faculty identified the chairperson as the most important individual during their first year. Nonetheless, there were cases where the chair failed to provide adequate support; this clearly added to the new faculty member's disenchantment. Lucas (1989) explained that most department chairpersons have had little if any formal training in leading, motivating, or supporting faculty. As a result, chairpersons may not recognize or know how to provide guidance and direction to regular faculty, as well as, and especially, to new faculty members.

Despite the numerous reports in this writing directed at the frustrations and potential dissatisfaction that first-year faculty members encounter, new faculty were for the most part optimistic about their forthcoming career (Boice & Turner, 1989; Sorcinelli, 1988). Boice and Turner (1989) revealed that the overall satisfaction of new faculty on the campus they studied to be 7.5 on a 10.0 point scale, and that "most planned to remain at the university for 10 years or more." Sorcinelli (1988) concurred: "This study found that new faculty members at our university were generally enthusiastic about their careers. ... They saw their work as providing a sense of accomplishment, autonomy, and opportunity for continued learning."

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Computer-Based Interactive Video: The Potential for Effective Instructional Environments

*Karen Lee Jost**

Introduction: Past Media Research

Past media research tried to show that the medium itself made a difference. To do this, comparisons were made between media, often comparing a new medium with traditional instruction where the two forms of instruction were made as similar (as equal) as possible. The only difference was in the medium delivering the instruction. Research studies employing experimental and quasi-experimental designs to compare instructional technologies have produced few useful outcomes (Reeves, 1986; Clark, 1983; Hoban, 1958).

Media comparison studies most often result in "no significant difference" conclusions. When such studies do show differences in learning between treatments, where the treatments use different media to deliver instruction, Clark (1987) argues that the differences are due to confounding and are not attributable to any one medium over another. He also identifies the most common sources of confounding in media research to be the uncontrolled effects of instructional method or content differences between treatments and the novelty effect of newer media, which tends to disappear in time (Clark, 1983).

Another problem with research using comparisons between media is that it assumes a prototypical or uniform medium. It does not consider within-medium differences as relevant. A further problem with much of the media research of the past is that it assumed uniform effects for all learners. Both Aptitude-Treatment-Interaction findings and observations of differences in how learners approach and perform activities render this assumption unwarranted.

Clark further disputes the theory that different media contribute to learning by providing attributes that cultivate cognitive skills. He notes that whenever an attribute seemingly specific to a medium is found that does cultivate a cognitive skill, it is not necessary for the acquisition of the skill because other attributes or presentation forms exist that will teach the same cognitive skill (Clark, 1987).

Salomon (1979) demonstrated that the symbolic modes employed by media can affect the mastery of mental skills, and how differences among symbol systems affect the acquisition of knowledge and affect cognition. He identified four aspects of media that may potentially affect learning: the technology they use, the symbol systems they employ, the content they convey, and the setting in which they are encountered. Winn (1987) added a fifth aspect: the thoroughness that goes into the design of the messages that they convey. But Winn then goes on to explain that symbol systems, contents and setting are simply correlates of a medium's technologies. They represent the general case of how a medium is used. They are not attributes that are inherently present in a medium and they may not be unique to any one medium.

In terms of research in instructional technology, the above distinction is very important. Research needs to be directed not at the medium, but at such things as instructional methods, the settings in which instruction takes place, the cognitive processes engaged through the use of symbol systems, the effect of how content is structured, and the use of learning strategies. It is also important to explain how individual differences affect how learners process or carry out instructional activities and to investigate the impact that various kinds of interactions can have on different learners. Refined questions focusing on specific salient attributes and qualities of a medium, such as the depiction of movement, also furnish us with important information which can be applied to the design of effective instruction. Research on symbolic elements of media must be done with caution. Elements producing an effect may be sufficient but not necessary to produce a cognitive effect (cf. Clark & Sugrue, 1989). The development of instructional theory is dependent on identifiying necessary conditions for learning.

Salomon has demonstrated that the way a learner perceives the source of information, i.e. the medium, influences the amount of mental effort expended in the learning process, and therefore, may affect learning (Salomon, 1983). He has also shown the importance of studying the context and environment within which instruction takes place (Salomon & Gardner, 1986). Relevant to research on instruction delivered by computers, as learning activities become more interactive and less structured, giving more control to the student, the range of experiences that students can encounter

increases as does the range of possible outcomes from the instruction (Salomon & Gardner, 1986; Linn, 1985). The diversity of possible outcomes presents difficulties for research which assumes the attainment of common goals.

Given all of the above problems that media research, including research on interactive video, has had in the past, why is there still interest in interactive video? What can it accomplish that other media can't already accomplish? Are there any real benefits from its use?

Analyzing the Task Before Choosing the Medium

Before proceeding with a discussion of the capabilities of CBIV as an instructional medium, it is important to begin with a method for analyzing an instructional goal which will facilitate the selection of an appropriate delivery medium. The selection of a presentation medium should not be predetermined before analyzing the problem before us. The effective design of instruction begins with an analysis of the instructional objectives, learner characteristics, and the environment in which instruction is to take place. Jonassen (1985) presents a taxonomy for interactive, adaptive lesson design which is helpful in analyzing the instructional requirements necessary for guiding the selection of an appropriate medium. He suggests that the instructional requirements be considered in terms of:

- task/content requirements of the objectives;
- type/level of learner-medium interaction;
- type/level of adaptation by the medium that is required;
- the characteristics of the medium needed to provide that adaptation.

Task/Content

Task requirements may vary as a function of the content or as a function of the objectives for the program. Learners should receive the treatment that best models the processing requirements of the task. The sequence of the presentation may also be altered to accommodate differences in task or content requirements. For example, the discovery or inductive approach (EGRULE) is recommended if the goal of instruction is for learners to be able to transfer rules to novel situations.

If learners are aware of the structure of knowledge being studied, their comprehension of the content improves. The structure or organization of the content that is being presented can be signaled explicitly to make it easier to comprehend. The structure of the content may also be reflected in the structure and sequence of the presentation. Structuring content at this level attempts to represent things the way they are. The different classes of content structure have been conceptualized to include world-related, concept-related, and inquiry-related perspectives (Posner and Strike, 1976).

Learner-Medium Interaction

The interactive dimension of interactive technologies describes the way in which learners respond to an instructional program. The more *mentally active* learners are as they process information from instructional materials, the more likely they are to generate meaning (Jonassen, 1985). The nature of learner-medium interactions can be viewed in terms of the task, the level of processing required to complete the task, and the context in which the instructional program will be used.

Task analysis needs to consider both the nature of the learning task and the content level of the material being processed. Learning tasks represent either "remember" or "use" learning behaviors. A "remember" task entails only recall; at the "use" level learners apply knowledge. Content level refers to the type of information being processed, which determines the type of knowledge constructions necessary for acquisition. There are a number of taxonomies which classify content. Merrill's Component Display Theory distinguishes between facts, concepts, procedures, rules and principles. Landa (1983) makes a clear distinction between knowledge and skills, emphasizing their interconnectedness (cf. Dijkstra, 1990). It is important to make both instruction and evaluation procedures consistent with the nature of the task to be learned.

Learning is a constructive process. Interactive instructional designs should encourage the learner to construct more elaborate mental representations, rather than respond reflexively to information on a screen. In designing interactive lessons, the designer needs to encourage the learner to access prior learning and relate the new material more consistently to it.

Adaptation by the Medium

Adaptive designs enable the delivery of alternative instructional sequences based upon a variety of learner, content, or situational characteristics. Lesson strategy or content can adapt to the learner (external) or to the information (internal). External adaptation can occur through:

- branching on performance;
- diagnosing prior learning;
- accommodating to learner characteristics;
- learner control of instruction;
- knowledge-based systems;
- curricular adaptations.

Instructional programs can internally adapt in terms of task requirements, content sequencing, content structure, and curriculum development.

Characteristics of the Medium

Computer-based interactive video is a complex combination of technologies. In order to fully understand its attributes, capabilities, and potentials we need to look at its many component parts. From an educational standpoint, we are not only interested in how they have been typically used, but in what they can potentially be made to do.

The aspects of media identified by Salomon and Winn (Salomon, 1979; Winn, 1987) as potentially affecting learning are important factors to consider when designing instruction and choosing a medium to use. A thorough analysis of the critical features of a medium or technology, its most essential characteristics, and the activities afforded by the medium, are also important considerations in choosing a delivery vehicle for instruction.

The most important capabilities afforded by computers as part of an instructional system include: the ability to engage the learner (requires interaction); levels of control (adaptability); and management capabilities (e.g. data storage and manipulation). CBIV is an interactive technology. Interaction need not be thought of as requiring an observable response. The activity should keep the learner mentally active through the use of authentic activities. The instruction needs to support learners in the construction of knowledge. Activities which require the learner to access prior knowledge to classify, compare or contrast to discover relationships or a structure to the content itself, support the level of interaction needed for the learner to acquire a meaningful understanding. Instruction can be designed which explicitly supplants mental operations accomplishing specific cognitive functions that some learners do not possess the skills to accomplish on their own. Supplantation can be used both to facilitate knowledge acquisition and to cultivate mastery of the mental skill involved. It has been suggested that the amount of compensation be manipulated, beginning with full support which is gradually withdrawn.

The effectiveness of an interactive design is dependent not only on the interaction itself, but on the way that the instruction responds or *adapts* as a result of the interaction. Instructional designs can adapt to the learner or to the information by adaptation of the lesson strategy or content (see Adaptation By the Medium above). Adaptation can also occur through learner control of the instruction. CBIV can provide learners with control over the range and depth of content, including the level of difficulty. It can also provide learners with strategy options, choice of examples (e.g. context, number), and choice of amount of practice. Learners may also be given control of the density of presentation, modality options, and navigational control, including the ability to exit and reenter the program. Learners are often given control over the pace of presentation, particularly where text is concerned.

While the idea of giving students control of their own learning has a strong intuitive appeal, research has shown that learners do not always choose what is best for them. Low-ability students often rush through instruction, while high-ability learners explore every possible branch of the instruction.

Research on Learner Control

Research on learner control of instruction indicates mixed results in terms of student achievement. Kinzie (1990) discusses possible explanations for the inconsistent results from research on learner control. The use of a behaviorist rather than a cognitivist orientation is presented as a possible source of inconsistent findings in learner control research. A cognitivist design allows for student control over direction and monitoring of the learning process. In a cognitivist design instruction also tends to be at higher difficulty levels and is presented in larger chunks. This type of instruction is more "far transfer" where the relevant outcome is long-range achievement and continuing motivation to learn. Therefore, in research where achievement measures are used which are more typical of a behaviorist design, (i.e. immediate recall, more "near transfer"), the real effects of learner control may not be measured.

The second possible source for inconsistent findings in learner control research, cited by Kinzie, is that of individual student differences. Individual differences play an important role in how learners process information and utilize control of instruction. One cannot assume that control is mindfully experienced (Salomon & Gardner, 1986; Chanowitz & Langer, 1980). Motivation, perception of task, and preferred learning strategy all affect how individuals tend to, or choose to, process information or perform activities presented to them during instruction (Salomon & Gardner, 1986; Salomon & Leigh, 1984). Learner control research has identified student aptitude, degree of inquiry, and prior conceptual understanding as individual differences which affect the use of learner control. Students possessing high aptitude, high inquiry, and prior content knowledge tend to benefit from the use of learner control.

The third source identified by Kinzie is that of discomfort/inexperience in exercising control options. To adequately measure the possible benefits of learner

control, whether achievement or attitude, students need to be experienced with using the technology and must know how to effectively exercise control. Instruction should include information about learner control options and practice in exercising them. Control options also need to be both appealing and non-threatening.

Research on learner control has shown that learners don't always make the right decisions in controlling or managing their own learning. This may often be due to deficient learning strategies, meta-cognitive skills, existing conceptual schemata, or motivation. Adaptive instruction, where computer-based algorithms prescribe the best strategies for individual learners, has produced higher levels of achievement than total learner control. But learner control studies do support long-term retention, positive attitudes, and a strong, intuitive appeal for learner control (Milheim and Azbell, 1988).

Learner control with advisement not only appears to be a good compromise between the benefits of adaptation and the appeal of learner control, but is also supported by research when compared with learner or adaptive control. Advisement can make suggestions on how to exercise control and when to use it. Advice can be given as to the optimal amount of practice which is needed, based on sophisticated models. Advice can also be in the form of information to aid learners in making decisions in managing their own instruction, such as how the student's performance compares to program criteria. Based on performance, students can also be advised to review previously presented content. When advising, a rationale should be provided so that students can make informed selections and may learn to manage their own instruction (Milheim and Azbell, 1988).

One alternative to full learner control is to limit the initial control which is given to the student, until the student can demonstrate that he/she possesses the basic knowledge schema required to make meaningful decisions as the instruction proceeds. As the learner masters the required basics, control can gradually be turned over to him/her. While students can be allowed to choose what instruction they feel they need, rather than simply allowing them to omit important information, they could be given the option of testing out of the instruction.

The Potential of Interactive Video

If media are only vehicles for instruction and do not directly influence learning, when is it appropriate to use them? Clark views the benefits derived from the use of media in education and training as being primarily economic in terms of saving a significant amount of instructional development, learning and delivery time, and money (Clark, 1987).

Bosco (1984) discussed several issues with regard to the implementation of videodiscs in education. He stated that , "Effective utilization involves an understanding of the points of convergence between capabilities of the interactive video system and the nature of educational tasks." (p. 14). The capabilities that he views as beneficial to the educational use of interactive video include:

- replicability and cost of instruction;
- responsiveness to human variability;
- active participation;
- the use of video information;
- assessing and managing instruction;
- the video chalkboard;
- the video (reference) book;
- the video teacher (intelligent tutor).

Some of the above capabilities are due to the computer component, others are due to the video component, while others are only possible through the unique combination of these capabilities.

Interactive video combines characteristics of video with characteristics of computers. When designing interactive video, the strengths of each are utilized. Computers and video complement each other; the strengths of one offset the limitations of the other. The primary strengths of video are its realistic depictions and ability to show motion. It also provides for quality audio. Video is generally limited by an inflexible linear presentation and an inability to engage the learner, who remains a passive observer instead of becoming an active participant. Video does not easily lend itself to the instruction of higher order skills and does not adapt to individual learner needs. The primary strengths of computers are their flexibility, levels of control, ability to engage the learner, and management capabilities. They are limited by a lack of realism and dramatic power. CBIV gives us the power to create a learning environment that engages the learner, can adapt to learner characteristics, can empower learners to take control of their own instruction and can utililize real images and motion, thus being capable of teaching not only higher order concepts, principles, procedures, and motor skills, but also lending itself to instruction dealing with attitudes. CBIV can also be used as a powerful tool to aid the learner in acquiring learning strategies and meta-cognitive skills.

One additional powerful application for interactive video is in distance education. The Yugtarvik Museum Project in Alaska is a good example of this type of application. This project developed culturally-relevant interactive programs so that students in distance education courses would be less dependent on learning over the telephone and more likely to become self-

learners through on-site interactive systems. The dual audio track on the videodisc made it possible to have the program presented in both English and Yup'ik (cf. Sponder and Schall, 1990).

The use of interactive video can provide both on-campus and distance students with a richer, more effective environment for learning. It can provide the additional benefits of magnifying live demonstrations, the ability to replay in slow motion, to show close-ups, to pause and rewind, and to choose time and place, that are not present with live lectures. CBIV can aid students in internalizing complex ideas and skills. It can offer applications in numerous contexts to aid in the transfer of skills to multiple situations. CBIV can provide students with a supportive environment within which they are allowed to think at their own pace, are given the opportunity to rethink assumptions, and have the time to reflect on their own learning (Ehrmann, 1990).

Conclusion

The potentials of computer-based interactive video will only be realized through the design of quality instructional programs and proper and effective implementation. In order to design quality programs, numerous interacting factors which affect the design need to be considered and thoroughly understood. Among these are the factors depicted in Figure 1.

When designing CBIV, the interactive and adaptive capabilities should be used to engage learners mentally, providing learners with activities which will aid them in constructing their own understanding rather than presenting information to be absorbed. Effectively designed instruction should help students to develop learning strategies and meta-cognitive skills. We should not use this powerful medium to present information to passive learners from which only the rote recall of information is required. Not only is such a use a waste of resources, but we will be running the risk of learners perceiving the medium as requiring little effort.

Most importantly, the best designs will not be effective if both teachers and students aren't taught how to effectively use both the technology and specific program options. The way that an instructional program is used is crucial.

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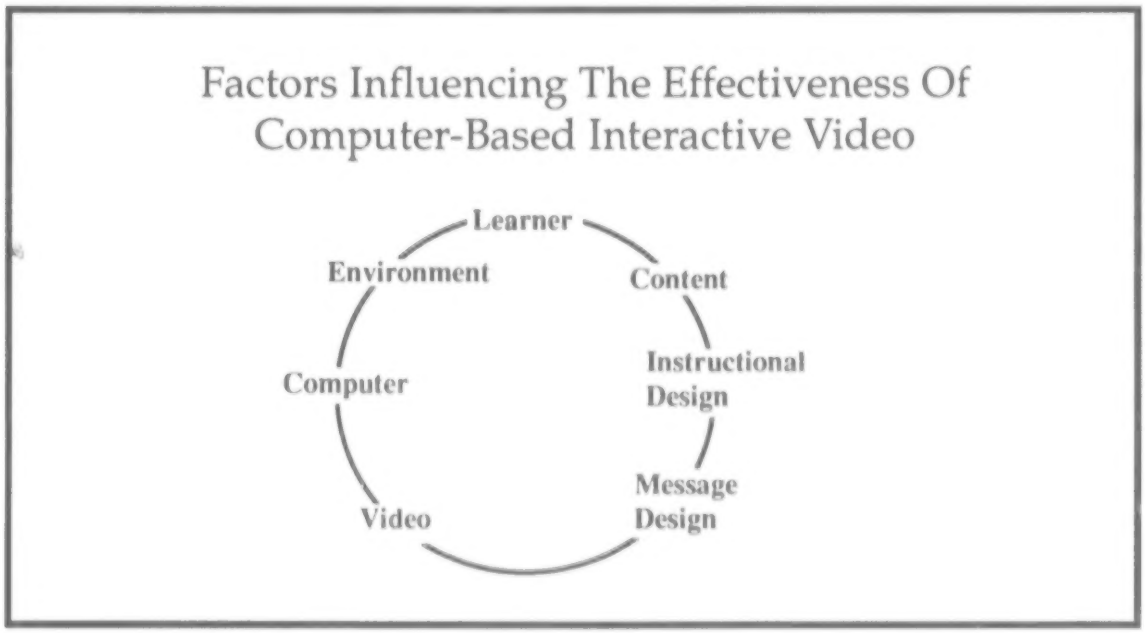

FIGURE 1. From Designing CBIV: Factors to Consider, Hypercard Stack developed by K.L. Jost

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AN INTERNATIONAL CONFERENCE AT THE NETHERLANDS IN 1991

The University of Twente, Enschede, in The Netherlands, will host the Second International Research Conference on Corporate Training and Development. Alexander Romiszowski of Syracuse University is on the organizing committee. The Conference will convene September 25-27, 1991, and is structured around the topics: *Training and development in a changing environment; Instructional design, instructional media and effective performance; Effectiveness of training programs; and (Inter)national studies.*

Paper proposals are invited to the Conference on these topics. There will also be a free track, in which papers can be presented that are more or less loosely related to the main theme of the Conference. Proposals for poster sessions, demonstrations, symposia and workshops are also invited. Paper proposals are to be submitted before March 1, 1991. The completed papers are required on July 25, 1991.

Please address paper proposals and all inquiries about the Conference to: Martin Mulder, University of Twente, Department of Education, P.O. Box 217, 7500 AE Enschede, The Netherlands.

Establishing an Instructional and Faculty Development Effort at SUNY–ESF: A Status Report and Perspective

Charles M. Spuches *

We are in the midst of an unprecedented period of interest in the quality of teaching and learning in higher education. Criticisms and solutions for assessing and improving the quality of education at the post secondary level abound in the academic and popular media. This article profiles one institution's proactive response to the challenge of maintaining and improving the quality of academic programs through an instructional and faculty development effort. Although several unique factors shaped this effort—the specific goals and expectations, the particular character and priorities of the institution, the key individuals involved, and the resources available—it provides lessons and examples that have implications for similar efforts. This report on our efforts here at the State University of New York, College of Environmental Science and Forestry (SUNY–ESF) is intended to be of practical value to instructional developers and academic leaders involved in similar efforts to establish or enhance instructional improvement programs in other college, university, or training and development settings.

Background/Context

The instructional and faculty development effort described in this paper is being conducted at SUNY–ESF in Syracuse, New York. ESF has approximately fifteen hundred undergraduate and graduate students and one hundred thirty faculty in eight academic units. Within its professional, disciplinary and research areas the College is one of the largest and most productive institutions in the country. The College enjoys a solid tradition and in several areas has an international reputation. ESF also has a long-established affiliation with its neighbor institution, Syracuse University.

In the late 1960s and early 1970s virtually all SUNY schools, including ESF, established Educational Communications Units. These units were equipped with one or more television studios and photo labs and were staffed with personnel versed in television production, photography, graphics, audio, film productio, and, on occasion, instructional development. While an instructional development line existed in the Educational Communications Unit at ESF, it was never filled. Over the years, through attrition and reassignment, the unit's staff decreased from eight to four (a television engineer, a media engineer, a photographer, and a secretary). Its role in providing support to the College's instructional, research, and public service programs, however, has continued.

In the spirit of renewed interest in linking college-wide course and instructor evaluations to instructional improvement, along with the initiation of a learning resources center concept within its library, ESF in 1986 initiated a search for a Coordinator of Instructional Development. The Coordinator position was to report to the Director of the Library and Learning Resources Center (LLRC) and to have two major areas of responsibility: (1) supervise the educational communications unit (renamed Instructional Services) of the LLRC and (2) provide instructional consultation and support to faculty and administrators. Instructional Services-related duties included supervision of the Unit's personnel, operations (e.g., media services, teleconferencing, video production), and budgets, as well as of the relocation and renovation of several of the Unit's major functions and facilities. The instructional development duties were not as clearly defined; rather they began to take shape during the first year and they continue to evolve. The remainder of this article will focus on the considerations that were addressed and the current elements in the instructional and faculty development effort.

The Innovation

By the fall of 1987 the College had in place its first Coordinator of Instructional Development and an instructional development effort was initiated. The new effort was guided by two key considerations: first, not to reinvent the wheel, and second, to make sure that the wheel fit. Every attempt was made to integrate and adapt to the ESF context the best of instructional development theory and practice in higher education conveyed through the literature (e.g., Diamond, 1989; Sachs, 1984) and gained through experience. There was a keen awareness and eagerness to avoid imposing approaches that were incompatible with the culture and priorities of ESF.

Although well established at several institutions, instructional development —the position as well as the person holding the position—was new to ESF and was considered an *innovation* as defined by Rogers (1983), (i.e., "an idea, practice or object that is perceived as new by an individual or other unit of adoption"). The implementation process was therefore guided by instructional and faculty development and diffusion of innovation principles (e.g., Centra, 1978; Davis, et. al. 1982; Kozma, 1985; Rogers, 1983; Shrock, 1985). It became immediately apparent that established approaches, especially the Syracuse Model (Diamond, 1989) with its emphases on a team approach to planning and on the cost effective use of resources, could serve as excellent starting points. It was imperative, however, to properly adapt and to further develop the model for ESF. ESF's particular characteristics, such as its size, science and engineering orientation, state affiliation, and unionized environment had to be fully considered.

An initial step was to identify key decision makers and opinion leaders (Rogers, 1983) who could guide, contribute to, and promote instructional improvement activities. This informal team consisted of the academic administration, department chairs, and faculty governance leaders, particularly the chair of the Committee on Instruction. An extension of this team consisted of curriculum coordinators (present in several departments) and individuals who had been recognized for their teaching excellence by campus and SUNY awards. Through formal meetings, a variety of publications, and informal conversations, this group (along with many other faculty) helped to identify the priorities and direction of the College and to formulate a plan that optimized instructional development resources (for example, see Diamond, 1989).

In time, two primary goals were established for the instructional development effort: (1) to complement and yet contribute in a unique way to the College's established network of instructional improvement efforts; and (2) to move beyond the efforts of a small number of individuals by engaging the majority of the faculty in new development efforts, thereby realizing the institutionalization of an enhanced instructional improvement program.

Since the use of instructional development services is voluntary (what Rogers, 1983, describes as an individual or optional type of innovation-decision process), the credibility of the developer as a colleague as well as the utility of the development process had to be established among the faculty. To this end, the instructional development effort was portrayed as one facet of an already ongoing system for enhancing the quality of teaching and learning. The appointment of an in-house instructional consultant with expertise in instructional systems and experience as a faculty member was submitted as tangible evidence of the College's recognition of and commitment to assisting faculty with their oftentimes competing responsibilities of teaching, research and service. It provided a person whose chief responsibility was to work jointly with faculty as a resource, linker, and consultant in order to facilitate their instructional improvement efforts. This approach, it was believed, would contribute to achievement of the first goal and would likely result in the acceptance and involvement of instructional development assistance in instructional, course, and academic program planning and decision making.

Realization of the second goal, institutionalization of an enhanced instructional improvement effort, was necessary if the effort was to result in long-term significant, positive impact upon the quality of the academic program and the environment in which it exists. This required broad-based commitment and active involvement in instructional development activities by faculty and all others associated with the academic environment. As Diamond (1989) explains:

> While we may focus on courses and curriculum, we should also keep in mind that what goes on in the classroom cannot be separated from the total instructional experience of students. No matter how effective we are as teachers, and no matter how well-designed our courses and curricula are, we will not be successful if our libraries are not conducive to studying, if our residence halls provide our students with little personal support, if few opportunities for recreation exist, and if we, as faculty, are rarely available to meet with students outside of the classroom, laboratory, or studio. Optimum learning requires a rich social, cultural, and physical environment. Such a setting does not happen by chance; it must be nurtured and planned and must involve the participation of staff from the offices of student affairs, residential life, and numerous other offices throughout the institution (p. 3).

The primary task during the effort's first few years was to guide faculty through the innovation-decision process. As described by Rogers (1983), "the innovation-decision process is essentially an information-seeking and information-processing activity in which the individual is motivated to reduce uncertainty about the advantages and disadvantages of the innovation." Rogers conceptualizes this as a five step process involving: (1) knowledge, (2) persuasion, (3) decision, (4) implementation, and (5) confirmation.

The particular mix of instructional development services and activities was selected based on the nature of this process, the goals outlined above, and on considerations of constraints and resources available. Key innovation characteristics that relate strongly to adoption and institutionalization, namely the innovation's relative advantage, compatibility, complexity, trialability, and observability (Rogers, 1983) were also considered in the planning process. These criteria aided the selection of strategies that would provide to faculty a balance of both short-term/immediate experiences with instructional development along with experiences that required long-term involvement. As an additional perspective, teaching was thought of as both a folk art and a fine art: a creative process that requires presence and spontaneity, similar to the improvisational abilities of a jazz musician or the adjustments of a master carpenter, as well as preplanning, analysis and design, much like the preparation and deliberations of a composer or architect. Resources and support were selected to address each dimension.

Elements of the ESF Instructional Improvement Effort

Brief descriptions of the current major elements of the instructional and faculty development effort are provided in the following section.

Seminars on instruction. A series of instructional and faculty development seminars entitled "Seminars on Instruction" was established. This approach was chosen to complement the once-a-year format already used by the institution. It was felt that instructional improvement, as a substantive process, required consistent if not constant stimulation. The seminars were intended to be a convenient way to keep the spirit of instructional improvement alive and active in the minds and schedules of our faculty. They were promoted as a means to introduce new concepts and approaches to teaching as well as to discuss and reconsider familiar topics. Also, since the development staff consisted of one individual, seminars were seen as an efficient means to disseminate information and interact with a wide cross section of faculty.

Seminars were scheduled regularly throughout the semester as noon-hour brown-bag lunch meetings. Coffee or other refreshments were provided. Faculty were invited to join with their colleagues to discuss important issues related to teaching and learning at the College. Seminars were presented either by the Coordinator of Instructional Development, by faculty, jointly, or by outside guests. An emphasis was placed on encouraging active faculty participation and discussion.

At the beginning of each semester a letter describing the tentative schedule and list of seminar topics for that semester was sent to department chairs and to faculty governance leaders. Their assistance in encouraging faculty participation was requested along with their ideas for future seminar topics. Key objectives were to select seminar topics that directly addressed faculty requirements and interests and to schedule them to coincide with the ebb and flow of the academic calendar. Topics to date have included, for example, syllabus development, collecting and using informal student feedback, instructor and course evaluations, the SUNY faculty grants program, and academic advising.

Announcements for each seminar are distributed to all faculty several days in advance and include a short tear-off at the bottom. Faculty are asked to complete and return the tear-off section to indicate their intention of participating or to share comments, again to gather ideas on topics of interest. Aware of the full schedules of faculty, the day before each seminar all faculty who indicated they would attend received a mailed reminder.

All seminars conclude with a short evaluation consisting of three closed- and two open-ended questions. These data, along with any and all anecdotal comments provided, are used to adjust seminar scheduling and format and to select future seminar topics. At the conclusion of each semester, a letter is sent to individual faculty to acknowledge their participation in the seminar or seminars attended as a demonstration of their active interest and commitment to our collective goal of instructional quality. A copy of each letter is sent to the appropriate department chair or supervisor.

Participation in the first six seminars totaled over one hundred faculty and staff, approximately seventy-five percent of full time teaching faculty. Related efforts have included offering a seminar for faculty new to the College and a seminar on academic management for department chairpersons to be offered in the fall of 1990.

Not all faculty have attended nor are they expected to. In effect, the seminar approach is a broad brush stroke. The downside of this approach is that it is difficult to determine if the ideas raised and information gained in seminars makes its way into the classroom or directly results in an improved teaching/learning environment. Nevertheless, the opportunity for faculty from across campus to gather to address teaching and learning issues is a cost effective and gratifying way to further the cause of instructional improvement. This opportunity for contact and interaction between faculty and the instructional consultant has resulted in a number of requests for follow up assistance.

Consulting. A second facet of the instructional development efforts is consulting. Consultations involve individual or occasionally small groups of faculty who want to explore a particular instructional topic or problem. Issues may be triggered by a recent seminar or emerge directly from the faculty member's current teaching assignment. While some consultations with a faculty member may require only one session and are comprised of a brief discussion, the sharing of materials, or the referral to another resource person, many involve several meetings over the course of several weeks. A high priority is given to all requests for consultation and are considered an important component of the development mix.

The time and effort spent consulting one-on-one with faculty is not without its limitations. Brief consultations often do not provide the opportunity for careful in-depth analysis of an instructional problem. Perhaps too often a quick fix to a symptom is addressed at the expense of identifying and analyzing an underlying problem. But such interactions do create opportunities for further development. If the faculty member finds this a productive experience, then consulting opportunities can be viewed as a preliminary step to more formal course or curriculum projects.

Course and curriculum development projects. By the Summer of 1988 there were opportunities for several course level projects. Course development projects involve working with individual or faculty groups to revise, update or restructure an existing course or to plan and develop a new one. Such projects follow standard procedures of established development units or agencies. They involve a team approach (developer, faculty as content expert, production staff, etc.) and are guided by project management, consulting and instructional design principles (for example, see Evensky and Spuches, 1989). In this mode, the developer works not from a discipline perspective but in a process facilitator role, providing instructional design expertise and project management skills. The process routinely involves helping faculty to clarify goals, organize content, design materials, and select teaching/learning strategies; in other words, to help make explicit many of the aspects of instructional planning that are often implicit or on occasion absent. The tangible outputs or products of such a process often include an enhanced syllabus or course guide, significant changes in content, and revisions in the instructional format of the course.

Two issues related to recent course development projects deserve comment. First, there have been occasions when new course or curriculum redesign efforts have occurred in which development services have not been utilized. On other occasions, development assistance was requested after critical design decisions were already made or were assumed to have been made. The challenge of overcoming resistance, of involving faculty, and of being involved in educational development projects is an issue addressed often in faculty and instructional development literature.

The concern for integration and utilization at ESF is, in part, the result of the voluntary nature of the innovation-decision process, although a voluntary approach is the favored one among instructional change practitioners. It may be a result, too, of instructional development being located within the LLRC, instead of being tied directly to the office of the chief academic officer, where it may gain more immediate visibility and credibility (Diamond, 1989; Sachs, 1984; Weimer, 1990). It is also due to factors commonly thought to impede faculty participation in development projects such as the competing demands on faculty time (for example, see Spuches & Doughty, in press). In any case, further formal and informal communication about the substantive role the development process can serve is necessary if the impact of instructional development services is to increase.

Second, many of the course development projects undertaken have involved either special topics, low enrollment, or elective courses. The opportunity to work on projects of this type could very often not be afforded at a larger institution which, even with the benefit of larger staffs, often must focus on the promise of higher impact. This opportunity to focus on projects that may be considered incidental in some contexts, underscores one of the unique benefits of in-house educational consulting services at a smaller institution. With a low development staff-to-faculty ratio a greater amount of flexibility and attention may be achieved.

Participation in College Faculty Governance. The Coordinator of Instructional Development position is a professional staff position. Shortly after the position was created, however, the College faculty voted to grant the Coordinator of Instructional Development local faculty status. This designation carried with it the opportunity to vote in governance meetings, serve on thesis and dissertation committees, and other privileges and responsibilities. Most notable was the opportunity to participate in faculty governance, first as a member and then as chair of the Subcommittee on Instructional Quality (a subcommittee of the Committee on Instruction, one of three core faculty governance committees along with research and public service). Involvement as an elected member of faculty governance was unanticipated. It has, nevertheless, come to be considered potentially one of the most effective and, without doubt, one of the most valued opportunities to

sense, a formal role in faculty governance legitimizes the role of the instructional developer as an instructional change agent and integrates instructional development within the faculty system.

A major undertaking of the Subcommittee on Instructional Quality was the recent initiation of the College's first newsletter on teaching and learning. To be published three times a year, this newsletter is a declaration of the faculty voice that quality teaching and learning is valued. The newsletter includes news on instruction-related events (seminars, grants and awards, etc.), articles written by ESF faculty, and excerpts or reprints of timely and relevant materials from a variety of sources. Although only two issues have been distributed, comments from faculty and administrators suggest the newsletter will serve as an effective way to disseminate information as well as to focus attention on and give recognition to the faculty's individual and collective instructional improvement efforts.

Summary

The mix of instructional and faculty development activities implemented at ESF is designed to optimize the impact of a single development staff member and to achieve both breadth and depth of involvement and effectiveness in facilitating instructional improvement. Although seminars and newsletters require moderate investments of production time, they reach a large number of faculty and reap important short-term rewards, particularly in addressing the initial stages of the innovation-decision process. Activities such as consulting and coordinating projects require more investment of time and take longer to establish but are likely to achieve more substantive long-term benefits. Involvement in faculty governance indicates a significant degree of faculty acceptance of instructional development and suggests that the development effort is on its way to institutionalization.

Certainly all expectations and goals have not been fully achieved, but with the concerted efforts of faculty and administrators, a foundation has been built for further work. Priority in the near future is to obtain external funding support for instructional improvement projects and to continue to build broad-based support for, and involvement in current instructional improvement efforts.

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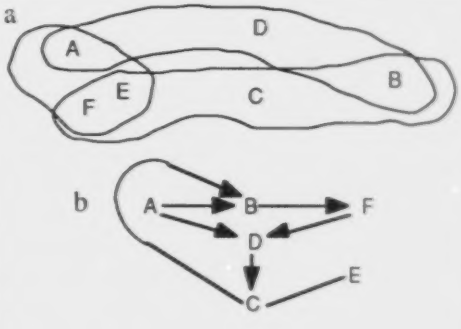
Job-Aids

Alex Romiszowski*

MAP #6 DEVELOPING STRUCTURAL COMMUNICATION EXERCISES: Procedure

Introduction

This job-aid is a continuatinuation of the maps structural communication methodology and their use in the design of automated case study excercise. This map can be no more than an overview of the process of designing, developing and producing Structural Communication units. Each step in this procedure would require one, or several, further maps to describe and document it fully. I have, however, given references to sources that describe specific steps of the procedure more fully. I have given references to sources that describe specfic steps of the procedure more fully. Full references are listed at the end of the article by Pusch and Slee, in the previous journal issue.)

Procedure	Step/Activity	Example/Method
1 "Macro" Analysis	1.1 Identify a Domain Choose a subject area/issue/ complex skill/ problem area which justifies expenditure of resources in order to improve human competence in "higher order cognitive skills".	Criteria for selection may be economic or drawn from educational philosophy, curriculum, idealism, humanism, or popular demand.
	1.2 Study the Domain Involved Is there a complex structure that must be "understood"? Does "understanding" at a deep level transfer to life/job competence?	Study expert/novice discrepancies and their root causes. Attempt a first "mapping" of the domain.
	1.3 Assess Suitability of S.C. Check that the domain being considered has many complex problem areas that require analysis/understanding/solutions. The successful expert strategies in the domain are not algorithmic, but require heuristic expertise and judgment.	"Understanding" is a variable rather than a fixed entity. Alternative viewpoints/theories exist and should be compared. Successful problem solving involves the weighing up of alternatives that have positive and negative aspects.
	1.4 Define "the overall intention" What is it that we aim to achieve by the S.C. exercise? What "insights" and "understandings" (rather than specific behaviors) are we hoping to promote? What overall problem areas are we going to investigate?	The "intention" at this stage is the goal we hope to achieve. To that extent, it is analogous to an "overall objective", but it may well be phrased in "process" rather than "product" terms. Later, this "intention" will be communicated to students, as a form of introduction.
2. "Micro" Analysis	2.1 Analyze the Selected Domain What are the concepts, principles and key facts of our domain? What are the relationships that exist among the elements? How do experts use or study this domain of knowledge?	Techniques abound: brainstorming; pattern noting (Field 19); mind-mapping (Buzan 1974). The analysis of experts' use of the domain may draw on any of the emerging knowledge acquisition techniques (card-sort; personal construct grid).
	2.2 Develop a "concept map" This is a visual representation of the structure of the domain, which may act as a guide to your later exercise design and development. The concept map is also a tool for validating your understanding of the domain against other experts. It may be developed by a team of experts, but if it is an individual creation, should be debated with other experts (of various "denominations," if possible). Two common ways of concept mapping are: (a) Entailment Meshes (Pask 19) that show "clustering" of ideas, and (b) Directed graphs/networks that show dependence/relationships.	

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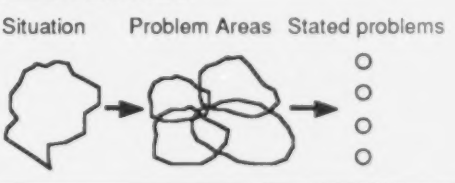
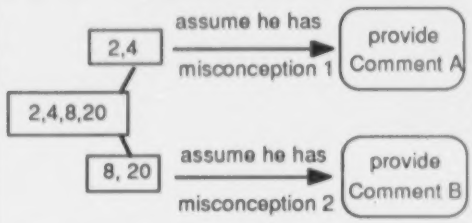
	2.3 Identify Dimensions and Viewpoints The analysis of the domain and the development of an overall concept map serves to identify the principal DIMENSIONS (content oriented) and VIEWPOINTS (people oriented) which underlie debate/divergence/uncertainty/opinion in the selected domain. These should be interrelated in order to identify the issues that might most usefully be addressed in your S.C. exercise. The dimensions and viewpoints can be better identified and INTERRELATED by constructing a DIMENSIONS-VIEWPOINTS TABLE. The example shows a table produced for a Business case study.	<table><tr><th rowspan="2">Viewpoints</th><th colspan="3">Dimensions</th></tr><tr><th>Technical viability</th><th>Social necessity</th><th>Financial viability</th></tr><tr><td>Management</td><td>?</td><td>?</td><td>?</td></tr><tr><td>Shareholders</td><td>?</td><td>?</td><td>?</td></tr><tr><td>Trade unions</td><td>?</td><td>?</td><td>?</td></tr></table>
3. Design of the Exercise	3.1. Select Overall Strategy The decision between basically "expositive" (reception-learning) and "experiential" (discovery-learning) approaches will influence most of the later design and development activities. Also, it is important to decide whether individual study or group discussion will be the primary mode of interaction with the S.C. package.	In "expositive" lessons, the S.C. exercise would be the "practice" stage which follows prior teaching of facts and theory. In "experiential" lessons, it may precede any teaching, presenting an initial "situation" for analysis, and in the discussion stage, leading to the "discovery" of both basic concepts and their interrelationships.
	3.2 Define the "intellectual challenge" This is the element of "deconditioning" of previously held assumptions, together with the element of "excitement" brought about by engagement in an interesting and complex problem-solving exercise. How will you author the exercise to achieve these two effects? What "specific tactics" can you think of?	The kind of challenge which is appropriate depends on the SPECIFIC INTENTIONS and on the STRATEGY selected, as well as on a variety of STUDENT CHARACTERISTICS. The "challenge" must bring the student "up against it" so he cannot remain passive towards the exercise. This is probably the most creative part of the S.C. authoring process.
	3.3 Define problem-set The issues to be explored (2.4) may already define the problem areas adequately. But it is important that the problems posed interact with each other presenting alternative/conflicting perspectives on a situation. Typically, between 3 and 6 interrelated problems should be defined at this stage.	The process of defining problem areas may be visualized as follows: 
4. Detailed Development	4.1 Select Response-Matrix Items Having got a first draft of the problems to be set (3.4), you can select/brainstorm items worthy of inclusion in the response-matrix. All the items pertain to the knowledge domain under study and most will relate to one or several of the problems (often in different ways). Typical relations are: Essential; Contradictory; Subsidiary; Irrelevant. By drawing up a "relevance grid" one can map the relationship of each item to each problem. This will help to select the most useful/powerful items. Here is a relevance grid for the selection of the response matrix items. Typically, continue to develop the list until you have 15-30 useful/powerful items.	<table><tr><th rowspan="2">Item Number</th><th colspan="4">Problem</th></tr><tr><th>1</th><th>2</th><th>3</th><th>4</th></tr><tr><td>1</td><td>E</td><td>I</td><td>S</td><td>S</td></tr><tr><td>2</td><td>I</td><td>I</td><td>S</td><td>E</td></tr><tr><td>3</td><td>I</td><td>C</td><td>I</td><td>C</td></tr><tr><td>4</td><td>S</td><td>E</td><td>I</td><td>C</td></tr><tr><td>5</td><td>C</td><td>I</td><td>E</td><td>E</td></tr><tr><td>6</td><td>I</td><td>E</td><td>I</td><td>C</td></tr><tr><td>7</td><td>S</td><td>I</td><td>E</td><td>E</td></tr><tr><td>8</td><td>I</td><td>S</td><td>C</td><td>I</td></tr></table>

	4.2 Develop the Discussion-Guide By examining the relations of all the items to a given problem, the author/expert/teacher may hypothesize (or indeed know from experience) why certain items that are essential may be omitted or why some contradictory items are often included, etc. This allows the author to plan a set of feedback comments related to particular misconceptions or viewpoints.	
	4.3 Develop the Presentation This may be an existing document or situation from which the domain structure (2.1-2.3), problems (3.2-3.4) and response-matrix (4.1) were developed. Alternatively, it may be necessary to write/produce a set of specially designed presentation materials, suited to the study skills of the target group.	Developing the presentation may call on special authoring skills such as: - Story/dialogue writing; - Case-study writing; - Role-play design; - Simulation/game design. In all cases, it is important that the materials "make sense" to the target students and that key relationships are neither too easy nor too difficult to discern.
	4.4 Develop the Comments The comments must be written so as to simulate a real dialogue with the reader. Also, they must interact with the presentation, intention, problems and viewpoints, so as to give a sense of "wholeness" to the S.C. exercise.	Some authoring hints: - use a conversational style; - avoid a dogmatic style; - avoid "right/wrong" classification; - ensure that the reader has some thinking to do as a result of comment; - indicate that the author's diagnosis of a student's response is tentative and open to error/bias.
	4.5 Editing/Finishing If necessary, write a final viewpoints section to round off the exercise. Review all the sections to ensure that they interact as expected.	- Are all sections similar in style/difficulty/challenge? - Are all comments related to problems and presentation in a clear and meaningful way?
5. Formative Evaluation	5.1 Developmental Testing Ask several students to work through early/incomplete versions of the study unit. These should be one-on-one situations, as the student can make free comments.	Problems must be in a fully defined state, but the feedback comments may in part be "ad-lib" or developed on-the-spot in response to student difficulties or questions.
	5.2 Expert Review Ask several experts/authorities to work through the study unit. Note their comments and the exercise in general and their specific responses to the problems.	Look for: - Technical inadequacies, and gaps in the "map" of the domain, incorrect diagnosis of student responses; inaccurate comments. - Viewpoints divergence, or the extent and specific issues on which the experts tend to disagree.
	5.3 Field Testing Try-out of prototype study unit under the conditions in which you expect it to be used in the future.	Consider use of the "coherence index" as a measure of the effectiveness of the unit. This index is a weighted measure of the number of points on which the student and the author "disagree". Identify any user factors that may affect the process of using the unit.
	5.4 Final Revisions As required.	Continue 5.1-5.4 for as many iterations as necessary to ensure the quality of the S.C. unit.

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MAP #7 DESIGNING AND DEVELOPING CASE MATERIALS: Procedure

Introduction

One form of presentation that may form the core of a Structural Communication exercise is a case-dsscription. This is a "scenario" describing a situation that requires comment or action on the part of the participants. The article on the Case-Study Methodology, elsewhere in this issue, outlined some general principles of case-study design. Here we shall elaborate on the design and development of the case materials. The procedure suggested here is, of course, also applicable to the design of case materials to be used in the more conventional, classroom-based, teacher led, case discussion methodologies. Aspects of this procedure are drawn from the Havard Method of case-study. Others are based on Message Design principles.

Procedure	Steps/ Activities	Examples
1. **Define the "problem"**	Define the concepts and principles to be exemplified/pointed out by the case. What generality or generally applicable skill should the participants practice through study of the case.	Harvard business cases generally focus on one management principle/strategy, such as effective delegation, or effective communication. The SU/IDD&E case studies give practice in specific heuristic skills, such as front-end-analysis or lesson planning.
2. **Analyze the problem and assemble the data. Select or create a "situation."**	Look for relevant examples in the participants' real-life (or future) environment, that can act as the basis of the case. True cases may be selected for adaptation. They may be found in the professional literature. "Fabricated" cases must often be created in order to meet the exact requirements of the "problem."	Sources of ready-made case material, for adoption or adaptation, include: books/collections of case studies; articles in journals; conferences/workshops. Sources of ideas and raw data for the creation of a case include: personal experience; experience of colleagues, organizational archives; articles in newspaper/magazines; evaluation studies.
3. **Design the case situation.** (a) Symptoms	The "symptoms": of the case are the factors that should "catch the eye" of the student and lead to an appropriate "diagnosis" of the general principles/phenomena that the case is exemplifying. These symptoms may be designed at different levels of "strength," thus making the case more "obvious" or more "difficult." Some should be "critical" to the case, others "incidental" and some "irrelevant." The "mix" of these is another factor in the "difficulty of the case."	In a case that is to exemplify the pressures and motivations on university faculty with respect to lesson preparation, a "strongly" presented symptom might be: "the promotion and tenure system does not reward my time investment in better teaching." A "weaker" version of this symptom might read: "I did not get the student handout written because I had this deadline to meet on an AECT paper."
(b) Structure	The symptoms are embedded in a structure—the interrelating elements or sub-systems of the case situation. Think of the situation in systems-engineering terms. Map out the sub-systems and their relationship to each other. Often these sub-systems are the "characters" of people who present the case data. Sometimes they are the characteristics of a given department or organization or group. Other structural factors to consider are: time-scale; a narrative, story-like context; fair balance between alternative viewpoints, reflecting reality; elements to create interest and motivation in the target group.	A case situation involving faculty development in a university may be designed as a system of viewpoints of the various interested parties—the university administration, the faculty itself, students, etc. These may be established in terms of generalities (e.g. a table of data from a staff or student survey) or as specific characters who voice characteristic viewpoints on the problem in question (e.g. Fred Aspen is head of faculty development—he sees the problem as follows . . .).

4. Develop the case material	Write the core description in detail. This will involve the creation of concise but clear and complete descriptions of all aspects of the situation, full "scripts" or dialogues for the characters, etc. Care must be taken to embed the previously defined "symptoms" in the case description at the required level of "difficulty." Care must also be taken to establish realism. Data and complex information should be tabulated or graphed and placed in well organized annexes for easy reference.	Some hints on style/structure: -Use past tense for evaluative (what went wrong) cases and present or future tense for decision-making (what will you do now) cases; -Use factual, unbiased style, avoiding implied comment/criticism; -Use common technical jargon and slang but avoid academic or over-technical descrip tions; -Avoid the inclusion of teaching material (definitions, concepts, theories) in the body of the case material; -Avoid the passive voice—put words into the mouths of real characters and give the characters names;
(a) Scenario Database		
(b) Questions	Usually, the case description is accompanied by questions. These have already been defined in earlier design stages. They must now be written, to match the details of the scenario. They may be open questions (e.g. what do you think should be done now) designed for group discussion, or more "Instrumented" (e.g. the use of a response matrix in Structural Communication).	An "open discussion" question might be: "having studied the viewpoints of the interested parties, what would you recommend to the head of faculty development at XYZ University"? An "instrumented" question might be: "Use the performance problem analysis schema of Romiszowski (1981)—select all the actions you think are appropriate to this case."
5. Evaluate the case material		
(a) Content	The factual content should be checked for authenticity, plausibility, technical validity.	-Use several subject experts as critics of the first drafts.
(b) Style	The Style and structure should be checked by other specialist case-writers.	-Several (possibly 3 or 4) different style/writing experts should be consulted.
(c) Developmental Testing	If possible, perform some developmental testing, by giving early versions of the case materials to two or more typical students. Revise and produce further drafts.	-Give the early drafts of the materials to sample members of the target group in a one-on-one situation. Record their decisions, misconceptions, and affective reactions to the material.
(d) Field Testing	Perform field-testing under the same conditions that are expected in future general use of the case.	-If the case material is planned for group discussion, then field test under these conditions. If the case is for individual study, then replicate these conditions. Some cases should be field tested in both of these modes.
6. Developing a Lesson Plan		
a) Briefing	Case materials are a part of a lesson. They should be established in an overall lesson plan. It may be necessary to specify to the user, just how the context of the case, and its importance should be introduced.	The briefing may be part of a "teacher moment" (group-discussion ones), or it may be an introductory presentation to be studied by the student (individual case study).
b) Case-Study	There may be a particular "dynamic" to the case-study stage. Also it may require "instrumentation".	Individual study/ small groups; special instrumentation; recording viewpoints; reporting back; synthesizing.
c) Debriefing	Finally, it is necessary to plan the process of promoting reflection ad discovery learning.	This is considered to be the most important and most difficult part of the task of case-method leadership.

MAP #8 STRUCTURAL COMMUNICATION AND CASE-METHOD: FURTHER READINGS

1. Structural Communication

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Hodgson, A.M. (1974). "Structural Communication in Practice". In Rominszowski, A.J. (ed.) *APLET Yearbook of Educational and Instructional Technology., 1975-75*. London, U.K.: Kogan Page.

Romiszowski, A.J. (1986). *Developing Auto-Instructional Materials*. London, U.K.: Kogan Page.

2. Case-Method

Bromley, D. B. (1986). *The case study method in psychology and related disciplines*. Chiclerter, U.K.: Wiley.

Chiesel, N. (1979). *The interactive case: Computerized techniques to teach the business case method*. Technological Horizons in Education. 6(5). 38-39.

Christensen, C.R. (1987). *Teaching and the case method*. Boston, Mass: Harvard Business School Publishing Division.

Masoner, M. (1988). *An audit of the case study method*. New York: Praeger.

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The SU-Indonesian Alumni Reunion and IUT Conference.

One important and thoroughly enjoyed component of the Syracuse summer adventure in Indonesia involved participating in the first comprehensive SU alumni reunion held in the country. Hosted by the Indonesian Open University, the National Center for Family Planning and the National Center for Communications and Technology, an evening of presentations, gift sharing, faculty remembrances and excellent dining was enjoyed by all. Syracuse schools and colleges represented includeed Maxwell, Management and Newhouse, and from the School of Education the Adult Education, Counselor Education and Instructional Design Development and Evaluation graduate programs.

In addition to Syracuse administrators, staff and faculty member participation, over one hundred Indonesian SU alumni and family members participated in the event held in Jakarta. Over twenty-five additional alumni hosted SU participants at the Improving University Teaching (IUT) Conference in Jogyakarta.

Syracuse was well represented at the sixteenth international conference on Improving University Teaching held this summer in the first week in July. Jointly sponsored in Yogyakarta, Indonesia by the Indonesian Open University, Gadjah Mada University and the University of Maryland, over 250 educational planners, researchers, developers and faculty met to discuss strategies and plans for instructional improvement in higher education.

Faculty, staff and administrators from Syracuse engaged in a variety of activities including a) theme sessions presentations, b) structured issue discussions, c) paper panels and d) workshops. In addition, many SU Indonesian alumni also presented papers, led discussions and joined with the SU contingent on panels.

Other obligatory conference events required participants to attend a traditional ballet with cast and orchestra of over 200 members, to have dinner at the Sultan's palace and to visit the Bourabador Temple, one of the seven wonders of the world, built in the 6th Century as a monument to Buddha.

Conference topics represented in the papers and presentations offered by Syracuse representatives included the following:

1. Ron Cavanaugh, Robert Diamond, Peter Gray and Tony Roberts - Changing Priorities at the Research Institution: Focus on Teaching.

2. Robert Diamond - Developing Teaching Skills During Graduate Education; A Practical Approach to the Design, Implementation and Evaluation of Courses, Programs and Curricula.

3. Phil Doughty - Aspects of the University Business Connection.

4. Peter Gray - Using Formative Data for Faculty, Course/Program, and Student Development.

5. Tony Roberts - Dealing with Problems: Lessons from Syracuse University's Sears Project.

6. Alexander Romiszowski - Use of Computer Mediated Communications as a support to campus based courses.

The Syracuse University Kellogg Project Enters Its Final Year

The Syracuse University Kellogg Project, a five-year research effort funded in 1986 by a grant from the Kellogg Foundation, is in its fifth- final year. The project has two main goals:

1. To process, promote research on, and provide broad access to the University's outstanding Adult and Continuing Education Research Collection, using optical disk and computer technologies. The collection contains more than 800 linear feet of manuscripts and other materials reflecting the development of professional adult education in the United States.
2. To promote information exchange through computer-mediated communications and, as appropriate, through nonelectronic means.

The following components have been developed to reach the project goals:

KLARS (Kellogg Library and Archive Retrieval System) was designed to bring computer power to bear on the process of researching archives and manuscripts in the Adult and Continuing Education Research Collection at Syracuse University. In KLARS, facsimile images of document pages are stored on optical disks, which can hold about 20,000 pages each. The system is designed to give researchers flexible access to these documents, using three different search strategies:

1. Browsing through documents that have been grouped on the system as they might be in a traditional archive. In archives, finding aids show users how the holdings are grouped within folders, within boxes, within collections. Individual documents are not specifically identified. Likewise, users of KLARS see screens that describe the contents of collections and folders, which users can then browse through electronically.
2. Referring to on-line contextual information about associated persons, organizations, or topics. Unlike books and periodicals, manuscripts such as letters, memos, meeting minutes, and the like were not written with scholars in mind. They are, rather, the artifacts of conducting business. So instead of looking for author, title, or subject, archival researchers ask about contexts, e.g., Which committee would have addressed this topic and when? Equipped with information about the contexts in which the documents were generated, users can more easily move around the data.
3. Conducting word searches. The system accommodates ASCII (machine readable) words about the documents, and it can also translate images of text into ASCII form. Users can tell the computer to look for certain word combinations likely to lead them to relevant materials. The system also ranks retrievals according to their presumed relevance to the search query.

KLARS allows users to cut references (which tell the computer how to find certain images again), take online notes, print out the notes, and order prints of selected facsimile pages (subject to copyright restrictions). For technical and administrative reasons, KLARS will not be fully implemented as a tool for researching the Adult and Continuing Education Collection. However, the solutions it offers to the problems of computerizing archives may be applied in other fields as well as adult education.

AEDNET is an international electronic network that includes people from the Americas, Europe, and the Pacific Rim. Technically, AEDNET is a listserv address on BITNET, which has links to yet other worldwide networks.

Approximately 260 people from 38 sites located in 10 countries are AEDNET members. Participants are primarily adult education professors and students, who tend to enjoy easy access to electronic networking. However, AEDNET encourages participation by practitioners and others outside academe.

Through AEDNET adult educators exchange information of mutual interest, while exploring this still-new medium for international information sharing. Network activities include: (a) network-wide discussions; (b) continuing small-group discussions on special interest topics; (c) job, conference, special event, and publication announcements; and (d) specific query and response exchanges. AEDNET relies heavily on participants' contributions and suggestions.

The network also serves as the distribution channel for the project's refereed electronic journal, **New Horizons in Adult Education**, which circulates free of charge to some 260 AEDNET subscribers. Designed in 1987, the journal's goal is to use the speed of electronic transmission to promote the exchange of current ideas among adult educators worldwide. Participants without computers may, however, submit articles and receive copies of the journal in paper form.

Past issues have carried articles by students, professors, and practitioners on topics such as adult development, feminist research methodology, adult literacy, and community development. Past issues are indexed in ERIC (Educational Resources Information Center).

The International Information Sharing Network (IISN) was designed to enable those without access to electronic communications to exchange information. The network is based on a model developed by Professor Marta Dosa of the Syracuse University School of Information Studies. Using traditional mail, the IISN links adult educators through an "information counselor," who responds to queries. A typical response includes referrals to knowledgeable network participants, addresses of publishers or organizations, and copies of articles, etc.

To date, the IISN has received more than 100 queries from adult education researchers, practitioners, and policy makers, more of them from Africa than from other continents. The IISN newletter, which includes contributions from participants, circulates three times a year to 355 people in 74 countries.

The Computers and Elderly Program is developed to provide the computer training to older adults who increasingly are using computers as vehicles for self-expression, communication, and learning. During the 1989-1990 academic year, four volunteer instructors at the project introduced 34 elders to word processing, data bases, simple programming, and telecommunications.

All older adults participating in computer classes must join SeniorNet, a nonprofit organization in San Francisco that was designed to create an international community of computer-using older adults. SeniorNet supports an electronic network that links elders with 28 sites throughout North America and Hawaii--including one at the Kellogg Project.

Some participants in the Computers and Elderly Program choose to become "computer volunteers," introducing local school children to computers. During the past year, eleven of these volunteer instructors taught 240 second- and third-grade children in two schools.

The Visiting Scholar Program is designed to enable scholars and practitioners to engage in individual research projects using the Adult and Continuing Education Research Collection. The program has also sponsored an international literacy conference and two conferences in adult education history. The literacy conference gave literacy practitioners from 18 countries an opportunity to meet on campus and discuss topics such as motivation, retention, and program development. The history conferences enabled scholars both to conduct individual research in the collection and to participate in group sessions.

The Kellogg Project has also been exploring computer-mediated communications as a **distance-education** medium. A computer conferencing software program was used successfully to deliver a course taught by Professor Roger Hiemstra in 1989.

****Further information on various project components may be obtained through the journal.**

Instructional Developments

A Journal of the School of Education at Syracuse University
Spring/Summer 1991 Volume 2, Number 1

Feature Articles

The Syracuse University Focus on Teaching Project: Changing Priorities at a Research University — *Robert Diamond, Peter Gray, Alton Roberts*

Research Reviews

What is the Role of Educational Technology in Generating Change in Public School Education? — *Richard Kenny*

Developments and Innovations

Establishing a Self-Instructional Development Facility at NAARM: A Status Report and Perspective — *Aradhyula Gopalam, K. V. Raman*

Formative and Summative Evaluation Procedures for Interactive Video in the Nuclear Industry — *Barbara Grabowski, Elisa Slee*

Automated Job Aids for Instructional Design and Development: Can Relational Databases Cut Costs? — *Michael Olson*

Job Aids — *Alex Romiszowski*

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Instructional Developments
Volume 2 Number 1

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This issue of Instructional Developments focuses on the improvement of instruction and the role of Instructional Systems Development in this improvement process. Three papers describe instructional improvement projects at the institutional (strategy) level. The remaining papers address tactical issues of implementing cost-effective instructional development.

The opening paper, by Robert Diamond, Peter Gray, and Alton Roberts, outlines work undertaken at Syracuse University over the last three years to improve instruction, particularly in undergraduate courses. This work commenced in 1989 with support for one year from the Sears Roebuck Foundation; it has continued uninterrupted and has already had a significant impact on undergraduate teaching. An interesting aspect of this work is its multidisciplinary nature: a real-life example of front-end analysis within an educational institution, carried through to the implementation of "systemic" multifaceted solutions. Performance technology in a university setting!

Richard Kenny's paper analyzes several approaches recently proposed for improving instruction in the public schools. These include drastic "top-down" reorganization or restructuring of the total system, "bottom-down" approaches that hinge on intensive and extensive training of teachers in instructional design and delivery, and "diffusion of change" models that cast educational technologists in the role of change agents, or organizational developers. The SU approach, outlined in the opening paper, is an example of this third approach.

The paper that follows was written by Aradhyula Gopalam, a FAO Fellow at Syracuse University, and K. V. Raman, both from the National Academy of Agricultural Research Management in India. It outlines the regular revision and updating process that all agricultural education curricula in Indian universities undergo every three years. It also describes a large-scale project for the improvement of instruction in universities by means of intensive use of mediated self-instructional materials to support classroom teaching activities, or to supplement them by means of distance education.

Barbara Grabowski and Elisa Slee examine current practices and models for formative evaluation of instructional materials, and suggest approaches for evaluating interactive media such as computer-based instruction and interactive video. As a case study, they describe a formative evaluation study of an interactive video program for safety training in the nuclear power industry, performed by staff and students from the School of Education's Instructional Design, Development and Evaluation (IDD&E) program.

Michael Olson discusses system components, examining progress in developing computer-based tools that may improve instructional design and development while reducing time and costs. As a case study, he describes a relational database management tool, called TRACE, specifically designed for use in large-scale instructional development projects.

The Job-Aids section this time is devoted to feedback and discussion of problems posed and issues raised in the earlier articles in this series. Any further reader comments that this feedback generates are most welcome and will be printed in future issues.

The Syracuse University Focus on Teaching Project: Changing Priorities at a Research University

Robert M. Diamond, Peter J. Gray, & Alton O. Roberts *

Background

In the spring of 1989, Syracuse University received a twelve-month grant from the Sears Roebuck Foundation entitled "Affecting Priorities at a Research Institution: Focus on Teaching." Directors of the project were Ronald R. Cavanagh, Vice President for Undergraduate Studies, and Robert M. Diamond, Assistant Vice Chancellor for Instructional Development. Alton O. Roberts and Peter J. Gray of the Center for Instructional Development (CID) played key roles in the development of the proposal and of the project guidelines. Because of the administrative commitment to the project and its potential impact on undergraduate programs, the effort was based in the office of the Vice President of Undergraduate Studies.

The goal of the Sears Project (as it became known on campus) was to enhance the perceived importance of undergraduate teaching at the University. The project had three purposes related to this goal: First, to help deans and department chairs gain a better understanding of how they influence faculty attitudes and priorities regarding teaching; second, to assist them in identifying activities and resources they could use to influence faculty attitudes and priorities most beneficially; and third, to indicate ways in which the Central Administration could support deans and chairs in these efforts.

The decision to focus the effort on deans and chairs was based on two major factors: First, these administrators are essential in changing both programs and faculty attitudes. As faculty leaders, deans and chairs influence instructional effectiveness in that their guidance and encouragement largely determine the level of effort that faculty devote to their teaching. In addition, deans and chairs have considerable impact on faculty members' perceptions of priorities and rewards, as well as departmental norms regarding the importance of teaching, and they allocate instructional resources.

Second, the size of Syracuse University (fourteen schools and colleges and over seventy-five departments and academic divisions) demands that change be implemented efficiently and effectively. Working with deans and chairs brought this effort to the greatest number of faculty in the least possible time with the greatest impact.

The First Year

During the first year of the project a committee conducted a survey, two campus-wide meetings, and a two-day meeting of chairs and deans from each school and college.

Survey of Perceptions

As the first step, the Sears Project developed and administered a set of surveys for distribution to faculty, deans, and chairs regarding their current perceptions of the balance between teaching and research at Syracuse University, the direction in which they felt the institution was moving, and the balance between the two that they would consider ideal. The survey had three main purposes: First, to provide data on the present climate of the institution; second, to identify strengths and weaknesses of the present reward system; and third, to provide base-line data against which changes over time could be compared.

The response rate to the survey was 70% from deans (10), 59% from chairs (27), and just over 40% from faculty (352). The data revealed respondents' perceptions that the Syracuse University campus as a whole valued research activity more highly than teaching. All three groups agreed, however, that a balance between teaching and research was essential for the health of the institution. The data also tended to show that the administration was perceived as placing far greater emphasis on research than on teaching. A significant number of respondents took the time to write powerful responses to the optional, open-ended questions on the surveys, which suggests that the issue is a highly charged one.

Summer Campus-Wide Conference

The project's advisory board used the results of the survey in planning a two-day conference for deans and academic chairs held in mid-July 1989. This conference provided participants with background information related to the goals and purposes of the Sears Project and developed support for the activities that were to follow. Topics covered at the conference included the status of higher education in the United States, an overview of national problems, a report of the survey results, a discussion of the roles of chairs and deans in the support of teaching, and a review of the role evaluation plays in improving instruction.

To provide the participants with some background for the conference, CID compiled a book of readings, *Improving Teaching: A Book of Readings for Deans and Department Chairs,* and distributed it to all participants prior to the conference. The readings consisted of discussions of the roles of chairs and deans in improving teaching and described effective instructional strategies that could be shared with faculty members. Time was set aside at the conference for deans and their respective chairs to develop school/college action plans to improve teaching in their units. Participants were also asked to make recommendations to the Central Administration regarding actions it could take to support teaching. To aid in developing action plans, reports of the survey's quantitative and narrative results, organized by school or college, were distributed to the deans and chairs. These surveys led to extensive conversations at the school/college level with many of the teams working late into the evenings on their action plans. These preliminary action plans were designed to serve as the focus for further school/college-wide discussions in the fall 1989 semester. The recommendations of the participants were sent to the Central Administration for review. A number of specific actions resulted. Announced in early December 1989, these results are described below in the section on the Fall 1989 Conference for Deans and Chairs.

In planning the summer conference, the advisory board had anticipated no more than 35 to 40 participants because many faculty and administrators travel or study during the summer. Attendance far exceeded this estimate. Over 70 administrators attended, including all but one dean and 40 chairs and division heads.

School and College Meetings

With the start of the fall 1989 semester the deans and chairs from each school or college began formal discussions on the action plans developed by their representatives at the summer conference. While some of these meetings included entire schools or colleges, others took place within departments. These discussions focused on such topics as evaluating teaching for promotion and tenure, improving teaching, and improving the overall undergraduate experience. The modification of the existing promotion and tenure guidelines began in some units. Several groups developed teaching support programs for new faculty during this period.

During September and October 1989 the project directors met with the deans and chairs of each school or college to discuss the activities that were underway and the problems they were encountering. A major area of concern that surfaced during these meetings was with the existing emphasis on traditionally defined "research." Most professional programs reported that the "traditional approach" to research and scholarship was often inappropriate in their fields. As a result they reported that significant scholarly work by some of their faculty was not being given adequate weight in the existing reward system. In some instances faculty were devoting their energies to "research" activities that were perceived as both inappropriate and counterproductive. On the other hand, they reported that course and/or curriculum improvement was hampered by a lack of rewards for these efforts.

Fall Conference for Deans and Chairs

Over 100 deans, associate deans, academic directors, and chairs attended this half-day conference in December 1989, which built on the activities that had begun in the summer. The conference began with a presentation by Russell Edgerton, President of the American Association of Higher Education, who focused on professional service activities and recommended their inclusion in the faculty evaluation process. Following this presentation, representatives of various schools and colleges reported on the status of their action plans to improve teaching. By this time some of the departments and colleges had already formulated, and in some cases implemented, specific programs to improve instruction.

In response to the recommendations made by the summer conference participants, the Central Administration announced several faculty instructional grant programs. In the initial year 58 faculty grants were awarded. In addition, CID announced a syllabus review service for faculty. Over 30 individual faculty and several whole departments have taken advantage of this offer.

While the Sears Project budget was modest, this external support enabled Syracuse University to implement some activities that would have had far less chance of being supported by the academic community if sponsored internally. The one-year Sears project formed the basis for an ongoing university-sponsored Focus on Teaching project .

The Second Year

Departmental efforts continued and the program was expanded during the spring, summer, and fall of the second year, 1990.

Spring Semester 1990

Although the 12 months of the Sears project had been completed, the Central Administration, supported by the deans and chairs, was committed to continuing the efforts begun through this project. The advisory board was asked to function as the coordinating body for this effort.

Based on the interest in the Sears project expressed by other institutions, two proposals (one to the Fund for the Improvement of Post-Secondary Education and one to the Lilly Endowment) were submitted during this period by CID and later funded. During the spring of 1990, schools, colleges, and departments continued work on their action plans. The stated 1990-91 project goals for each school or college were to:

- develop and implement standards for promotion and tenure that would evaluate and reward teaching;
- develop a definition of scholarly and creative activity appropriate for their discipline;
- formulate and implement within their academic areas a program in support of teaching; and
- obtain an appropriate balance between teaching and research/scholarly activity in their faculty reward system, promotion, tenure and annual salary review procedures.

The advisory board decided that during the 1990-91 academic year the project would focus on the two major elements of the faculty reward system: in the fall on evaluating teaching and then, in the spring, on redefining and evaluating research and scholarly activities.

Summer 1990 Workshop on the Evaluation of Teaching

At the invitation of Syracuse University's Chancellor, more than 135 administrators and faculty members participated in a one-day workshop just before the start of classes in late August 1990. The faculty who were invited were nominated by their deans because of their important roles on tenure and promotion committees.

The workshop assumed the following premises:

- that teaching can be evaluated;
- that the evaluation materials used must be sensitive to the specific teaching assignment of the individual faculty member;
- that evaluation data can support improvement of teaching and intelligent promotion, tenure, and salary decisions;
- that the evaluation procedures and the methods of reporting must be appropriately adapted to the intended use.

In placing this workshop in perspective the Vice Chancellor for Academic Affairs stated:

> In a very direct sense, our declaration of an enhanced role for teaching and learning at Syracuse must be matched by an increased emphasis on quality performance and this must be reflected in our academic reward system. To reward such quality we must be able to evaluate it in a highly professional manner—just as we evaluate research, scholarship and creative professional accomplishment. For this reason alone, today's workshop and the activities it will undoubtedly spin off are of great importance to our future at Syracuse.

Following a brief history of the project, four department chairs distributed detailed information about the teaching evaluation plans their departments had developed. These chairs were selected because each had developed a different approach. The chairs, from Economics, Bioengineering, Foreign Languages and Literatures, and the Writing Program, discussed how their plans had been developed, the rationale behind them, and the problems that they had encountered. In addition to focusing on the evaluation of teaching, the director of the Writing Program also addressed the issue of research and its definition in that academic area.

Following these discussions, the deans met with their chairs and faculty participants to begin developing plans for programs to evaluate teaching effectiveness. To facilitate the process, each team was provided with a planning worksheet (see Figure 1) that focused on both the various purposes of the evaluation and the specific questions that were addressed in a report to be submitted at the end of the fall semester.

To assist them further, all participants were provided with a copy of A Guide to Evaluating Teaching for Promotion and Tenure (Centra, J., Froh, F. C., Gray, P. J., & Lambert, L. M., Diamond, R. M., ed.; 1987; Acton, MA: Copley Publishing Group). The final session of the summer workshop introduced the teaching portfolio, which was recommended for possible use by second-year faculty in preparation for their third-year review and for use by promotion and tenure committees.

SCHOOL OR COLLEGE WORKSHEET

There are five areas that have the potential for being the focus of teaching effectiveness evaluation:

1. Annual review and merit pay decisions.
2. Formative evaluation for new faculty (focusing on the improvement of teaching).
3. The promotion and tenure process beginning with the third-year review and ending with promotion to full professor with tenure.
4. Periodic review of professors with tenure.
5. Annual rehiring decisions for part-time, non-tenure line, and adjunct faculty.

Consider the following questions relative to each of these situations:

- Should evaluation of teaching be required or voluntary?
- Who should be involved in the design of the evaluation process? (department chair, promotion and tenure committee chair, CID evaluation professional, etc.)
- If problems are identified, what steps should be taken to correct them? Who and what offices should be involved?
- In which year(s), and how often should evaluation take place?

Figure 1.

Fall Semester 1990

As schools and colleges continued to develop their plans for evaluating teaching, a major effort began to inform the entire campus (students, faculty, and staff) about the on-going project and its significance. The summer workshop on evaluating teaching was featured in The Syracuse Record, the weekly administrative publication of the University, and was reported in the local press and in U.S. News and World Report. A major portion of the Chancellor's Annual Report to the Faculty was also devoted to the importance of teaching and to this project, its activities and significance.

As of April 1991 formal plans for evaluating teaching have been completed by a number of schools and colleges, while others are in the process of developing plans and having them approved by the appropriate committees. Many of the plans have common elements; however, several of the larger schools/colleges have allowed individual departments to develop their own plans using college-wide guidelines (e.g., College of Arts and Sciences, the Maxwell School of Citizenship, College of Engineering).

The Third Year

While attention will continue to be paid to the evaluation of teaching, the focus will shift during year three (1991) to the development of discipline-specific definitions of research/scholarship. This activity will build on the recent work of Ernest Boyer and Eugene Rice.

Three major activities in 1991:

April — In mid-April 1991 our 400 faculty attended a major address by Ernest Boyer, President, Carnegie Foundation for the Advancement of Teaching, on "The New American Scholar." This activity was sponsored by the Chancellor's Office, with faculty, deans, and chairs receiving personal invitations.

May — A seminar "On the Nature of Scholarly Work" was held in early May, with over 80 deans, chairs, faculty, and administrators in attendance. Co-chaired by the Vice President for Undergraduate Studies and the Vice President for Research, this working seminar was structured to set the stage for school and college discussions that will begin in the fall. After an introductory presentation by Eugene Rice, participants had the opportunity of discussing various aspects of scholarly work in both cross-disciplinary groups and by individual schools and colleges.

Fall — At the direction of the individual deans, school/college and program discussions on the nature of scholarly work would continue. These will likely result in appropriate modifications of the criteria for reward, promotion, and tenure.

The third year of the project will continue to focus on improving support systems for teaching faculty, with particular emphasis on evaluating the performance of tenure-track faculty in their second through fifth years. In addition, a new proposal to work directly with a number of major national professional associations in the redefinition of scholarly work has been submitted for funding. It is hoped that work will begin on the project in the fall of 1991.

A Final Observation

While there may have been some skepticism about the feasibility of realizing particular objectives, this was clearly the right project at the right time for Syracuse University. Students were increasingly vocal about their perception that inadequate attention is paid to teaching (a national movement, Undergraduates for a Better Education, was founded at Syracuse). Faculty and administrators were also becoming increasingly uncomfortable with the conflicts between the research and instructional missions of the University.

Significant change seldom happens by chance. It requires the commitment of key academic leaders, sensitivity to the environment of the institution, and a systematic and participatory approach to change. From the very beginning this project has involved academic leaders including deans, academic chairs, and faculty members. Each year the number of deans, chairs, and faculty members attending project-sponsored activities has increased until, in its third year, the project hopes to reach the entire academic community with the scheduled lecture by Ernest Boyer.

Throughout the project many different people in the academic community have been involved in developing the criteria, evaluation instruments, and support programs that are necessary for the long-term success of a project intended to improve both the perceived importance and actual quality of undergraduate teaching. From its inception this project has enjoyed the general backing of most campus faculty and administrators. For many people, stressing the importance of teaching and of improving instruction was not only a goal that they could support, but one to which they willingly devoted time and energy.

In addition, the availability of a center with expertise in evaluation and faculty development was essential for the smooth implementation of this project. In essence, CID served as the support agency for the day-to-day operation of the project, as well as the special project-sponsored events.

While the current fiscal and enrollment problems common to private colleges and universities have reduced, to some degree, the energies and resources available for this project, there is little doubt that the issue of teaching at Syracuse has been elevated in importance and that the rewards for teaching excellence are increasing. It will be several years before we can determine whether we have achieved the ultimate goal of our project, to improve the perceived importance and quality of teaching, particularly at the undergraduate level, by the balanced integration of teaching and research. To date, although progress toward this goal has varied substantially, many academic units have far exceeded expectations in the scope of their action plans, the energy devoted to this project, and the speed with which elements of the plans were implemented.

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For Further Information:

- The Syracuse University Focus on Teaching Project (A Progress Report: The First Two Years), 67 pages, $6.00
- The Syracuse University Focus on Teacher Project–School and College Plans for Improving Teaching (Selected Examples), 85 pages, $9.00

Available at: Syracuse University
Center for Instructional Development
111 Waverly Ave., Suite 220
Syracuse, NY 13244

- A Guide to Evaluating Teaching for Promotion and Tenure, 63 pages, $12.95.

Available at: COPLEY PUBLISHING GROUP
138 Great Road
Acton, MA 01720

What is the Role of Educational Technology in Generating Change in Public School Education?

Richard F. Kenny *

Introduction

The need for change in public education has been a topic of much discussion during the past decade. While the field of educational technology has not been immune from the debate, it has yet to make a strong impact upon the schools. Salisbury (1987) notes that "while instructional design skills and approaches were becoming well accepted in business and industrial training, it was difficult [for educational technologists] to make inroads in improving instruction in public school settings" (p. 2).

Such remarks presuppose that schools need to improve. But do they? This question can be answered from a number of points of view. Fullan (1982) stresses that educational changes are not ends in themselves but must be considered in relation to the basic purposes and outcomes of schools. Innovations should be introduced to help schools accomplish their goals more effectively by replacing some programs or practices with better ones. He lists two major purposes for schools:

- to educate students in various academic or cognitive skills and knowledge;
- to educate students in the development of individual and social skills and knowledge necessary to function occupationally and sociopolitically in society (p.10).

Modern society, however, has not remained static and, therefore, both the academic and social skills required of its citizens must of necessity adapt. Schools reflect society and are constantly under pressure to change with it. A current example of this is the technological impact of computers and the development of the information society. In this aspect, society is changing rapidly. Schools, though, have been slow to adapt (Dalton, 1989). Successful examples of computer use in classroom practice are still relatively rare (van den Akker, Keursten & Plomp, in press). And yet, technology will continue to shape our processes and systems of schooling and will have an important role to play in the future of education (DiSessa, 1987, Foster, 1988). Even in the absence of overt demands, the need for change is always there.

More expressly, in the United States, and to a lesser degree in Canada, there has been a repeated demand during the past decade from various sectors of society that public education be restructured. In the United States, various reports and books indicating the "need" for improving the quality of instruction have abounded (e.g., Boyer, 1983; Goodlad, 1983). The National Commission on Excellence in Education, created because of "the widespread perception that something is seriously amiss in our [U.S.] educational system" (1983, p.1), was particularly critical of American schools. Theorists in the field of educational technology have also advocated wholesale change (Reigeluth, 1987; Branson, 1987). The overt, sometimes strident, tone of the debate in the United States may reflect the large involvement of the federal government in education as well as perceptions of the competitive position of American society in the world order.

Canadians appear to be less concerned about the state of their educational system. Maguire (1986) indicates several reasons: Education is strongly entrenched as a provincial responsibility; there is a tradition of a conservative, non-interventionist supreme court; and the time lag between the creation of ideas in the U.S. and their movement to Canada leaves space to evaluate and pick the best. Indeed, Canadians appear generally satisfied with their schools. Lee (1988) found that, in Manitoba, 48% of the public gave elementary schools a "B," while 41% awarded high schools a "C." A Canadian Education Association sponsored Gallup poll (1984) found respondents more confident about Canadian schools than about other institutions. As well, 43.8% gave their schools good grades. While positive, "B" and "C" grades do indicate that Canadians think their schools can improve.

Fullan indicates several reasons, based on research, why schools require change:

- Many innovative teaching practices of the new curricula of the 1960s and 1970s have not been implemented despite their endorsement in na-

tional, regional and local policy statements.

- There is an almost arbitrary variation and emphasis in classrooms on some subjects over others, with many teachers teaching in subject areas for which they have limited preparation.
- Teachers do not have time for reflection or analysis either individually or collectively about what they are doing.
- There is every reason to believe that the textbook industry dominates the teachers' field of choice in many states in the U.S. and several provinces in Canada.
- Change is needed because many teachers are frustrated, bored, and alienated.
- Most teachers do not take the initiative to promote changes beyond their classroom because of their cultural conditions and practical concerns (1982, pp. 116-120).

And finally, Fullan, Bennett, and Rolheiser-Bennett (1990) have indicated that more is now known about effective schools. Educators have learned a great deal about classroom and school improvement recently and are able to make more informed decisions. From almost any point of view, it seems, there is a need for change in public school education.

The Role of Educational Technology† in Public School Education Change

Given that change is both needed and possible in public school education, what role can educational technologists play in the process? Salisbury (1987) notes three distinct approaches to improving public schools: school system reorganization, the teacher-training approach, and the diffusion/adoption approach.

Change the System

One approach is to argue that long-lasting change will only occur if school systems are radically reorganized. However, views of how to do this vary widely (Heinich, 1984, Reigeluth, 1987; Branson, 1987).

Heinich (1984) claims that the application of educational technology can result in superior instruction in schools. In his view, "the basic premise of instructional technology is that all instructional contingencies can be managed through space and time... Primary emphasis is given to the development of more powerful technologies along with the development of organizational structures that facilitate their use" (p. 68). Such organizational structures would place subprofessionals (aides) in the most frequent contact with students and reserve professional contact for specific, instructionally-oriented purposes. Educational technologists would create change in public education by creating large-scale mediated instructional systems to replace the current system.

Branson (1987) postulates an *upper limit hypothesis*. He attributes declines in school performance and quality to an obsolete management model, improvements to which "have reached their practical upper limit; that is, performing in the vicinity of 97% to 98% as well as they can ever function according to the current design philosophy" (p.16). This archaic classroom concept should be abandoned in favor of a school environment that is designed for function; that is, both individual learning and group processes. Branson advocates the use of the systems approach, but in conjunction with change models, improved management models, and other approaches for improving instruction. Educational technology has a role but is not the sole player.

Reigeluth (1987) offers the most explicit vision. He calls for the development of a *third wave* educational system, one which would "make use of a variety of means of learning, including peer tutoring, discussion groups, projects, and group activities of various kinds, in addition to well-designed individualized resources and learning environments" (p.5). Piecemeal modifications of the present system will not work, and system-wide planning and modification are required. Reigeluth offers a blueprint for a cluster system operating on an entrepreneurial basis. Teachers, working cooperatively within clusters, would serve as guides to help each child meet individual goals. Much of the instruction would be provided by independent *learning labs* to which the clusters would have access. Like Branson, Reigeluth views educational technology in a service, not commanding, role.

Which, if any, of these positions is feasible? Although Heinich insists that educational technology provides a clear alternative, his position on the capabilities of the field is in dispute (e.g., Clark & Sugrue, 1988; Kerr, 1989). Nor does he take change theory into account. His approach demands fidelity of implementation or what Berman (1981) termed a *technologically dominant* process. Berman, however, notes that "the interaction between an educational technology and its setting can be uncertain because of the technology's characteristics

† AECT's Definition Committee currently defines instructional technology as "a discipline concerned with the systematic design, development, evaluation and management of instruction and instructional materials" (Branch, 1990, p.6). Educational technology has variously been viewed as either including, or a part of, instructional technology. Regardless, the field is most often associated with the systems approach.

or how it is used" (p. 262). How an innovation is implemented may be as important to outcomes as its initial technology. Neither Heinich nor Reigeluth have addressed this point. Only Branson discusses change models. Regardless, the pressure for large-scale changes is not likely to bear fruit because of the diversity created [in the U.S.] by state and local control of education and because "that control is rooted in the United States Constitution by the strongest kind of political support" (Burkman, 1987, p. 31). That argument holds true in Canada as well. Further, considerable research (Berman, 1981; Fullan, 1982) has indicated the difficulty of implementing and institutionalizing even small-scale change.

Teach the Teachers

Other educational technologists propose to train teachers to use the systems approach to improve instruction. Snelbecker (1987) advocates that teachers be taught instructional design skills both in preservice and inservice education. He contends that teachers "need at least fundamental instructional design strategies to plan, evaluate, and modify instruction as a regular and continuing part of their classroom duties" (p. 35). He offers several suggestions for addressing "technology transfer" problems, including providing assistance to teachers in recognizing how instructional design techniques can be made relevant for their day-to-day activities, assistance for integrating content and method, and assistance in recognizing how some aspects of a theory may be adopted or adapted for their setting. Further, Snelbecker postulates that contemporary uses of microcomputers in education might lead to increased interest in instructional design skills and provide a window of opportunity.

Shrock and Byrd (1987) suggest that educational technologists would "find it instructive to examine the messages that are currently being delivered to teachers through staff development [because it] is one of the most influential forces currently impinging on teacher behavior" (p. 45). They argue that the instructional design model has much in common with both the effective teaching message and the reflective teaching message, but offers a more comprehensive schema. They advise educational technologists to become involved in preservice teacher education in order to provide teachers with a "frame of reference to put instructional research findings into perspective and to apply the results conditionally" (p. 52). As well, educational technologists should enter the debate taking place within the field of staff development.

Schiffman (1987) takes a different tack. She suggests that educational technologists train *internal* change agents. That possibility exists in the role of the school media specialist. It is her view that "technological developments and the growing interest in information literacy have brought school library media centers to prominence among educators" [and that] "the computerization of library systems is also finally making it possible for school library media specialists to devote a portion of their time to instructional matters" (p.41). Schiffman notes that more than a third of all graduates of educational technology programs take positions in school library media centers but tend to come from programs that emphasize "media" rather than "instructional systems design." She argues that these school library media specialists be competently trained in instructional design theory and the use of computer and information technologies. Thus armed, they would be well equipped to act as in-house change agents by providing design and production advice to teachers.

Such indirect approaches are more likely to succeed than advocacy of wholesale change to the public school system. Rather than an implementation dominant process, they represent what Berman (1981) terms *mutual adaptation*; that is, both the innovation (the application of the systems approach) and the organization adapt. Berman suggests that effectively implemented innovations are characterized by this process. As well, by considering teacher practice, they are also indicating the appropriateness of the innovation, an important step according to Fullan (1982).

However, it is not clear that any of these proposals take into account all three dimensions of change that Fullan considers necessary to achieve change. They address the possible use of new teaching approaches and the possible alteration of beliefs, but not the provision of new or revised materials. It is presumed that teachers, or school library media specialists, will use the newly acquired skills to develop their own. These proposals fall one step short. Even educational technology graduates often find it difficult to make full use of the systems approach in the field (Rossett, 1987; Lange & Gravdahl, 1989).

Take a Diffusion/Adoption Perspective

Some educational technologists believe that members of the field can be effective *external* change agents. They stress the application of change theory in effecting reorganization in public school education.

Burkman (1987) claims that current school practice does not even meet the minimal requirements for instructional systems design (ergo educational technology). Goals often remain tacit and objectives left unstated in behavioral form. The most realistic way to get instructional systems design utilized in the class-

room is to work to reduce the complexity of the existing system. He advocates focusing at the local school system level, developing projects that concentrate on a single subject, and focus on subjects that are skill-oriented and easy to attack with these techniques.

Dalton (1989) asserts that educational technologists make ideal change agents. The systems approach allows them to determine whether a change is needed, analyze the environment, evaluate the consequences of their actions, and decide on courses of action based on the best evidence available. The problem with past uses of the systems approach, he points out, are that "our efforts to create 'teacher-proof' materials neglect the basic motivations of the most significant obstacles to change in that [the school] environment: the teachers" (p. 22). He advocates that educational technologists examine their solutions in light of the wants of the implementors.

Dalton offers several suggestions, some of them similar to previously discussed proposals, e.g., train selected school personnel as educational technologists and create magnet schools to demonstrate alternatives. The majority, however, involve creating instructional materials and working with teachers directly to effect change. These suggestions include: (a) building cooperative computer-based learning environments and friendlier computer interfaces, (b) developing software integrated with routine curriculum objectives, (c) providing teacher training in the use of the particular innovation, (d) letting the teacher make the decision about the use of computer technologies, and/or (e) defining new roles for the teacher as counselor, developer, and manager.

Kerr (1989) concurs with many of Dalton's points. He rejects the views of Heinich and others who would strictly apply the systems approach for ignoring schools as social institutions and focusing narrowly on the transmission of information. He outlines four areas of congruence among the concerns of the educational technology and school reform communities:

- the preparation of models of teaching-with-technology;
- the design of software;
- the creation of computer-based tools to support teachers' professional development;
- the improvement of research on teaching-with-technology.

Mappin and Campbell-Bonar (1990) provide an example. They developed an approach to the development and implementation of interactive video that stressed building client involvement and presenting alternative approaches to instruction and theory at different points in the process. Their approach began with the identification of an instructional problem and identified seven selected points of intervention:

- audience analysis, keeping both the instructors and students in mind;
- identifying educational and training needs;
- Stating detailed learning objectives in terms of "plausible" responses to classroom situations;
- media selection appropriate to instructor needs;
- acceptance of the final design by key decision makers;
- (the production phase) working with a core design team with the provision to allow key decision makers to review work at specific points;
- (the implementation phase) introducing the final product; holding inservice sessions for instructors at the beginning of the term; and supporting materials, a utilization consultant, and ongoing equipment and technical support (pp. 8-11).

Emphasizing the importance of implementation led to a model that helped ensure that process but also led to materials more directly tied to perceived problems.

Conclusion

It is the diffusion approach advocated by this last group that appears to offer educational technologists the greatest likelihood of success of eliciting change in the public schools. It takes full advantage of their expertise by allowing them to apply their instructional design skills to the improvement of instruction and also takes into account Fullan's (1982) three dimensions of change. In fact, these writers have independently suggested many of the criteria advanced by Fullan, Miles, and Anderson (1988) as necessary for an effective strategy for implementing microcomputers such as local responsiveness, initial acceptance of an uncertain target, provision for increasing target clarity, and intense, sustained, responsive assistance.

Educational technologists must maintain a realistic view of what their design techniques can achieve and continue to improve them in light of developing theory and technology. That, coupled with a sound knowledge of change as a process and a willingness to accept the role of external change agent working in cooperation with teachers, administrator, and other educators, could make them valuable indeed in initiating needed change in public school education.

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Establishing a Self-Instructional Development Facility at NAARM: A Status Report and Perspective

Aradhyula Gopalam and K. V. Raman

The Role of NAARM in Improving Agricultural University Education

Over the last four decades, Indian agriculture has recorded remarkable increases in agricultural production and has acquired considerable resilience and stability, largely through the generation of better technology in land and water management, input use, control of pests and pathogens, and adoption of scientific production techniques (Anonymous, 1989). This success has underlined the necessity for better management of agricultural research, education, and transfer of technology systems to production in the agricultural sector. Realizing the need for an institutional setup to impart training in agricultural research-project management and for adopting principles of educational technology in agricultural education, the Indian Council of Agricultural Research established the National Academy of Agricultural Research Management (NAARM). The academy has conducted numerous training programs, workshops, and seminars in educational technology and structured learning for the faculty of agricultural universities. The Educational Systems and Technology Unit of the Academy is especially interested in organizing research and in conducting training programs in higher agricultural education with an emphasis on curriculum development, instructional systems, production of learning resource materials, evaluation and assessment, and educational administration. NAARM has undertaken several research projects and case studies to help generate more effective and efficient approaches and methods in the higher agricultural education system.

Overview

In Indian agricultural universities the curriculum is revised every five years to introduce new subject areas. The faculty often find it difficult to cope with revising subject matter areas without curtailing the instructional hours in their own schedules. However, the revision is necessary because agricultural graduates with outdated knowledge in their fields of specialization cannot do justice to the farmers or the employers recruiting them. Thus Indian agricultural education faces two important challenges. First, the curriculum undergoes an upward revision at designated intervals to accommodate the latest knowledge on such interdisciplinary topics as tissue culture and pesticide residues. Second, the faculty offer resistance to change in instructional management and delivery systems, often pleading that, in the best interests of their learners, certain fundamental aspects of their respective subjects cannot be ignored. If instructional hours are to remain the same while new areas are introduced, then self-instruction for specific course segments may be a realistic solution.

This article seeks to explore the underlying principles of self-instruction as applicable to Indian agricultural education and the efforts of NAARM in bridging the gap between learner-centered and teacher-centered instruction.

Present Scenario of Instruction in the Indian Agricultural University

Agricultural education in general, and instruction in particular, is designed as part of a social system attempting to address the food scarcity problem. Instruction continues to become increasingly complex with the need to modify curricula to accommodate newly emerging subjects, along with their interdisciplinary and multidisciplinary configurations. As new subject matter has to find a place in the undergraduate curriculum alongside the elementary aspects already taught, possible solutions include either teaching some of these subjects at the pre-university level or creating them as self-instruction. It is in these new contexts that self-instructional systems of teaching and learning appear not only necessary but urgent. Nonetheless, self-instructional systems have yet to take root.

Indian agricultural colleges and universities may require their students to learn from specially prepared teaching materials. Teachers and trainers may have to involve themselves increasingly with self-instructional

materials. This may be done through on-site self-instruction or through correspondence (distance learning). In both of these modes, learners must rely on specially prepared teaching materials, as they have less personal contact with teachers than do traditional students, who meet regularly in classes. Private study materials need not be as carefully prepared in conventional instruction as in self-instruction, where materials are specially selected, written, and modified with particular learning objectives in mind. Self-instructional materials have to be preplanned, prerecorded and prepackaged (Heidt, 1989). Subject matter may be presented in instructional texts, tape slide presentations, videotapes, or computer-aided tutorials, assignments, and exercises. These materials must carry out traditional teacher functions such as clarifying, exemplifying, elaborating, guiding, motivating, provoking, expounding, explaining, reminding, discussing alternative answers, appraising each learner, and giving appropriate remedial or enrichment help.

NAARM has developed an infrastructure for creating and imparting models of self-instruction. The faculty of the agricultural universities are invited to use NAARM facilities for improving instruction. There are high quality professional studios where resource materials can be generated for use in agricultural universities. Subject matter specialists visit these facilities and generate the resource materials for this purpose. A summer institute is held annually for the faculty of agricultural universities where the major emphasis is placed on curriculum planning and design. The course content of each of the subject matter areas is carefully scrutinized and suggestions are made for developing the curricula and for including new subject matter.

Design Steps for Self-Instructional Planners

In December 1990 NAARM conducted a national workshop on self-instructional systems. At this workshop educational planners, course authors, and curriculum designers suggested that planners of self-instruction consider the following steps in creating self-instructional materials:

- formulate aims and objectives for materials production;
- identify the skills, knowledge, and attitudes that learners must possess before using the materials;
- sequence the materials to help learners proceed logically;
- select appropriate areas of study and matching media formats;
- write scripts to suit the media and desired self-instructional outcomes of given programs;
- design assessment tests or situations that will assess learners' terminal behaviors;
- test modules in a pilot study to determine their effectiveness in achieving stated learning objectives;
- improve the designed materials in light of evaluation results prior to wider dissemination.

There are advantages and disadvantages in developing self-instructional course content. Advantages include maximum freedom in choosing content, treatment, sequence, and production scheduling. The instruction can be designed as a coherent whole with no obvious gaps or undue repetitions. Emotional energy need not be wasted in defending the course content and method (Romiszowski, 1988). The course material can be adapted and updated to accommodate the learner's experience.

The disadvantages are that faculty will have limited personal contact with students. Also, a lack of technical skills in such areas as typography, audio-video taping, and graphics may hamper effective presentation of the material. In addition, more time may be required to produce the required course material than is available (Anonymous, 1990).

Establishment of Self-Aided Instructional Laboratory (SAIL) in NAARM

In NAARM efforts were made in 1990 to establish a Self-Aided Instructional Laboratory (SAIL) to improve learning and teaching within agricultural university education. The laboratory provides a computer terminal, one VCR color monitor assembly, and one telex caramate. There is a work space for recording observations, with a common discussion area and an area for laboratory exercises. The facility was established for individual use by students and trainees. The teacher is not directly involved. A table partitioned with panel dividers creates individual learning spaces known as carrels. These carrels are distinctly different from typical library carrels. They are equipped to accommodate a variety of learning resources such as tape recorders, phonographs, slide and overhead projectors, reading machines, and computers. The growing trend is to equip each carrel electronically so that prerecorded sessions, programs, and other resources can be transmitted to them. Generally, carrels are located in libraries, classrooms, study areas, or separate learning labs.

Carrels and other facilities in SAIL have created an environment conducive to the intellectual pursuits of both students and teachers. As a result of activities in the laboratory, a number of learning modules have

been prepared by different subject matter experts from various agricultural universities. These self-instructional materials have immediate use. For example, agricultural entomologists were not competent in organic chemistry, so that they did not understand such matters as the structure and metabolism of pesticides. To compensate for this deficiency, self-instructional material was designed and provided to them. Also, the pesticide residue chemistry course, which cannot be added to the curriculum because it would increase student credit loads, was introduced through a self-instructional package. SAIL was designed to facilitate such learning processes by addressing individual learner needs in this manner.

In December 1990 a national workshop on self-instructional systems for higher education in agriculture was introduced to the professionals in the field. The faculty were exposed to various learning modules and equipment. A study conducted in this workshop provided feedback on the design of the workshop, as well as the development of an effective system for learning and teaching agricultural subjects in NAARM.

Conclusion

As new areas of development in science and technology are included within the agricultural education system, learner-focused instruction is gaining ground, as compared to teacher-focused classroom instruction. The Deans' Committee of the Indian agricultural universities, appointed in 1989 for the modification of curricula, has indicated that credit loads in agricultural education are not sufficient for a basic undergraduate course. The basic science component that should be imparted in undergraduate courses is also being debated. With faculty not ready to compromise by decreasing credit loads for undergraduate students, and students feeling the heavy burden of the already existing syllabus, the concept of self-instruction has become significant.

Each year Indian agricultural universities introduce new courses. Given the need to implement instructional management on the forefront, it is worth devising a more effective method for imparting education. The incorporation of self-instruction into Indian agricultural education should be an important means for improving the quality of the present educational system and a step toward improving learner interaction in new areas of development. At the same time it is a step toward progress, equality, and the democratization of education.

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Formative and Summative Evaluation Procedures for Interactive Video in the Nuclear Industry

Barbara L. Grabowski & Elisa J. Slee *

Introduction

While there is evidence that new technologies are prevalent in homes, schools, businesses, and organizations, there is a growing awareness that the present evaluation of new technologies is inadequate. Hannafin and Peck state, "Despite its promise...evaluation is probably the most overlooked component of systems models" (1988, p. 299). An examination of the literature reveals that, in spite of the existence of interactive video for over a dozen years, there is little documented research on its effectiveness, or in-depth formative or summative evaluation projects. Most predominant in the literature are descriptions of use, descriptions of hardware and software capabilities, and guidelines for the future design of interactive video.

An argument could be made that computer-based interactive video (CBIV) provides the means for incorporating effective instructional designs because of its combination of computer and video technologies in a single instructional medium having the capabilities of text, graphics, realistic video images, motion, audio, and intelligent branching in which the sequence and selection of output are determined by individual user input to the system. Each of these attributes presents an area for possible research and/or evaluation.

While more empirically-based research and evaluation studies are appearing in the literature, the lack of existing evidence of the effectiveness of design strategies using new combinations of attributes available with this technology is of some concern. This concern arises because of the fact that poor or ineffective instructional design could condemn the technology to the same fate as linear video in the 1960s or could lead to a negative "page-turning" image of computer-based instruction. That fate of CBIV could include inappropriate use as well as dissatisfaction or outright rejection of the product by users and trainers.

This article will focus on the area of evaluation of interactive video in general, addressing current practices in the field. It will then describe one successful evaluation project for nuclear training.

Current Strategies Employed in Evaluation of Interactive Video

Typically, evaluation of interactive video products is carried out at the prototype stage of product development rather than throughout the entire project. Johnston (1984) cites some of the reasons why the contribution of evaluation to new technologies is not as great as it might be:

- product development is done by people who are not aware of the contribution that formative research can make,
- there is not a demand for summative evaluation data,
- there is no controversy about the impact of the new technologies,
- evaluators have found it difficult to adapt the traditional evaluation models to the new technologies.

Braden (1987) warns, however, that an increasing number of educational technologists think of formative evaluation as end-product only. He strongly urges that designers and developers start at the front end of the design process, suggesting that the procedures used to develop the product need to be evaluated, as well as the products themselves.

Current Practices of Formative Evaluation

The purpose of formative evaluation is to determine the effectiveness of instructional products as they are being produced and in their near-final form. In a CAI context, Hannafin and Peck (1988) have defined evaluation as an ongoing process used to (a) determine whether lesson objectives have been met, (b) identify the reasons for the observed performance, and (c) identify those portions of the lesson that require modification. Dick and Carey (1985) posed three stages of formative evaluation that are standard in most development projects. The first

stage, One to One Evaluation, is informal. It is used to identify major problems associated with the planned design. In this stage, the designer might consult and observe another designer, subject matter expert, and/or student while they proceed through the design. Valuable information concerning a lesson can be obtained before unnecessarily expending energy to develop the lesson.

The next stage, Small Group Evaluation, is conducted when the lesson is nearly done. Its purpose is to determine the effectiveness, acceptability, and appropriateness of strategies and materials, and the extent of compliance with constraints identified in the needs assessment. This stage is more formal than the one to one stage. It does not have to be conducted in the actual setting. Performance data are collected to identify where, or if, lesson improvements are needed. The final stage, Field Test Evaluation, is conducted in the actual setting. Lessons are of final-draft quality and formal techniques are employed. There is little designer-student interaction at this point.

Suggestions for the Evaluation of Interactive Technologies

While these stages and procedures for formative evaluation are essential, there are other points and strategies in the development of interactive video where formative evaluation could save expensive redesign. Since pressing a disc results in uneditable video, any design problems with the video must be identified early in the project. Any redesign after that must be dealt with by eliminating the video sequence, either by programming around it, or by including computer images. Unique evaluation strategies are necessary to combat complicated procedures for trial runs due to branching (Patterson and Bloch, 1987). Also, interactive video technology is not one type of media, but rather several—each of which requires its own evaluation criteria. Finally, the end product is very difficult to envision during the earlier stages of development.

In the literature, evaluators suggest several strategies for evaluating interactive technologies. Pearson (1988) reviewed evaluation models and suggested three useful attributes for the evaluation of microcomputer courseware, which may be applied to the evaluation of CBIV: measurement of student outcomes (Tyler's Objectives), professional judgement (Provus Discrepancy Model), and assessment of incidental learning (Scriven's Goal-Free Model). He tested these models in the evaluation of CAI instruction and found them to be effective. It follows that they would be appropriate for evaluating interactive video as well.

Use of case studies is one evaluation methodology posed by several evaluators. Johnston (1984) advocates "greater use of naturalistic observation and case studies to develop hypotheses about how technology interacts with users and context" (p. 83). Ingle (1984), Rice (1984), and Johnston (1984) used this strategy to evaluate how learners interacted with microcomputers and interactive video products. These video case studies were useful for examining how hardware and software factors influenced user responses to programs. Rice argued that these media "offer new communication functions and new technological designs, require new human capabilities, and suggest new specification of contemporary theories." When Ingle evaluated Project BEST using this method, he used the videotape to provide an aggregate of vivid concrete instances of how practitioners handled the introduction and use of microcomputers. Thus generalizations were easily portrayed and interpreted by others. More appropriate decisions could be made because the stakeholders were able to get a vivid sense of the effects of the microcomputers in actual classrooms. The video case study approach also allowed the design team to compare applications across several school sites. Further research areas were generated from the review of the tapes and the comparisons made by the evaluation. The tapes provided contextual information that is often bypassed in normal research reports.

Fedale (1985) recommends another method for circumventing some of the typical design problems encountered by new designers of interactive video programs: using a video template of the design flowchart as part of the formative evaluation process. With a character generator, Fedale produced different colored screens to represent video sequences, menus, still frames, and graphics. The videotape of the design flowchart was then presented to the designer for review, which resulted in a number of design changes. Fedale felt that the video representation approximated the final product more closely than the typical review of the storyboard. Since it was a more realistic portrayal, design changes were made that might have been missed in a paper review. Employing such a procedure as a type of formative evaluation saved later expenses in interactive videotape production and editing. A similar procedure could be used for formative review of interactive video discs by subject matter experts to consider errors of content, sequence, terminology, definitions, descriptions, message design, and branching.

Dick (1987) asks whether there is a fundamental conflict between the design of interactive instructional systems and the application of formative evaluation procedures to improve the effectiveness of these systems. He argues that many CBIV projects seem to have misunderstood the potential of the new media for the improvement of education. CBIV designers seem to work to maximize the use of the presentation options

and branching capabilities rather than concentrating on maximizing the learning outcomes. One's choice between these approaches to the design and development process will influence the type of data collected and the evaluation process selected.

Evaluation Project for General Employee Training in the Nuclear Area

The training staff of a local nuclear power company recently developed a computer-based interactive video project to improve the consistency of General Employee Requalification Training. The computer-based interactive video was to address problems of labor-intensive instruction for instructors and trainees, various trainee backgrounds, and varied employee schedules without diluting quality. Expected results included greater flexibility, convenience, and a reduction of training time. The interactive nature of the medium was also expected to increase retention and motivation for learning the material.

An Instructional Design, Development and Evaluation team from the Training Systems Institute at Syracuse University School of Education was contracted to evaluate the development of this project. An important advantage was that the team was contracted early in the project so that recommendations could be made at every stage of the development process.

There were five tasks associated with this project:

- Task 1: Courseware flowchart and script analysis (evaluation of the instructional design specification, or "blueprint");
- Task 2: Talk-through protocol (equivalent to Dick and Carey's first stage of one-on-one evaluation of instructional effectiveness);
- Tasks 3 and 4: Technical and mechanical review (debugging the courseware);
- Task 5: Beta test (approximates to Dick and Carey's second stage of small-group formative evaluation of instructional effectiveness).

Task 1: Flowchart and Script Analysis. There were three subtasks associated with the flowchart and script analysis. The first included a review of the design document and preliminary material. Goals and objectives were reviewed at this stage for clarity and measurability. Criteria for evaluating the objectives were made clear to the development team so that they would understand the rationale behind any recommendations made.

Following this review, the flowcharts were analyzed for effective design and logical flow. Several recommendations were made at this stage, based on problems with the performance strategy that the team had identified. Much discussion of the ramifications of various strategies ensued before the development team finally selected a strategy that would accomplish their goals and be within their budget constraints.

Scripts were written by the development team and then reviewed by the evaluation team. These were reviewed from several perspectives to take into consideration the variety of media available in computer-based interactive video. These perspectives included "design" to determine whether the content matched the objectives, "flow" to determine if the interactivity of the computer was being used appropriately, and "video" to determine whether principles of good message design were being employed with the motion video and computer screens. Much discussion resulted as various advantages and disadvantages were presented for strategies they were employing. The decisions the development team ultimately made were much more informed and deliberate than those presented beforehand.

Task 2: Talk-Through Protocol. From these scripts, video was shot on tape and computer graphics were developed. With these, a talk-through of the lesson was conducted. The purpose of the talk-through protocol was to examine the functional and informational value of the script and video. Specifically, instructional, learner control, and learner input and output components were evaluated. A naive learner was selected for this task. The video was shown via tape with the developer controlling the sequence. The learner read the scripts and viewed the videotape and computer graphics where appropriate. Several areas of confusion were identified through this valuable exercise. Most of the value arose from identifying confusing areas within the video.

As a result of this talk-through, video segments were reshot prior to videodisc production, graphics were revised, and content was rewritten. The lesson was then programmed on the computer, and the videodisc was sent to mastering.

Tasks 3 and 4: Technical and Mechanical Review. While the technical and mechanical review was to have been conducted prior to the pressing of the master disc, this was deemed unnecessary because of the fruitful results of the talk-through. The review then consisted of identifying typographical and logistic errors in the computer program after the beta test and prior to full-scale implementation. This review is a very important step in preserving the integrity of the program because it prevents frustration in the actual students who ultimately will use the program.

Task 5: Beta Test. Once the videodisc was pressed and the computer lessons programmed, a beta test was

conducted to provide comparison data on four types of training effectiveness indicators: time-to-completion, performance, student satisfaction, and efficiency. These comparison data were important to determine whether interactive video would be an appropriate alternative to existing training strategies, and to determine where problems existed in the interactive video lessons themselves.

The four comparison groups included (a) those naive learners who had received instructor-led training and then took the testing portion of the interactive video lesson, (b) those who used a print study guide and then took the interactive video test, (c) those who took the interactive video lessons and the interactive video test, and (d) those who just took the interactive video test.

Numbers of correct and incorrect responses, amounts of time per session, and interest and appeal data were collected via computer, surveys, and interviews. These data were analyzed and recommendations were made for revision. Three significant problems were identified, and it was strongly recommended that they be addressed prior to full-scale implementation. Additional minor problems with recommended revisions were also flagged as non-critical areas.

General Strategy

The strategy the team employed was a factor that contributed to the effectiveness of the evaluation project. The materials produced for each of the tasks were reviewed by the evaluation team. Recommendations were then summarized and presented verbally to the development team for discussion at the plant site. This discussion resulted in a mutual understanding of the specific objectives of the project and the rationale for recommended revisions. This personal iteration was viewed as a critical component of the success of the evaluation process, because it allowed misunderstandings, which often occur with written documents, to be circumvented immediately. Trust was developed among the team members, which helped the evaluation process to work. Production tips were also passed along throughout the project to make the process easier for the development team. Very positive comments were made by the development team throughout the project regarding the value of the recommendations being put forth.

Results

Full-scale evaluation of each phase of the design process resulted in a product that is used and enjoyed by the majority of employees. Although the novelty of the new technology currently may be carrying the lesson, it is clear that the lessons themselves are motivating, and the additional advantages of reduced time and more flexible and convenient scheduling will ensure that the lessons continue to be used. If the three-phase process alone had been employed, developers probably would have been too frustratedto sustain the effort of producing the final product. Even if they had, the product would not have been as effective.

Conclusion

This article stressed the importance of in-depth evaluation of interactive video development projects, some current thinking about how it should be conducted, and one evaluation example. There are, however, additional questions that suggest the need for a broader, total-systems approach to CBIV project evaluation. Does the technology get used? By whom? For what purposes does it get used more than other techniques? What is the social impact of the technology? How does the new technology replace what existed? When does it supplement or totally replace other alternatives? How pervasive is the new technology and how does it impact other elements of the organization?

There is much to be learned about the impact of interactive technologies, and empirically-based, process-oriented evaluation projects will begin to provide some of the answers needed to launch effective interactive instruction.

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THE TRAINING SYSTEMS INSTITUTE/SUBSTANCE ABUSE COUNSELOR TRAINING PROJECT

Training Systems Institute (TSI) has developed training manuals to be used by the Division of Substance Abuse Services (DSAS) of New York State for training 10,000 substance abuse counselors who work throughout the state. Although these counselors have diverse backgrounds and perform varied functions, they all need certain basic competencies. The curriculum being developed will supply training in the knowledge and skills required to achieve these competencies.

A variety of organizations and specialist groups provide training for substance abuse counselors. The project also involves looking at the courses currently offered and revising them both to update them and to transform them into competency-based materials that incorporate self-study wherever possible. This is intended to reduce the length of courses and to make training more accessible to a larger number of counselors.

The project is conducting occupational analysis to identify key competencies within all the job categories that call for substance abuse counseling. The analysis is being done by means of a Delphi study, which commenced with an exhaustive list of competencies identified during some half-dozen previous projects, mainly in the area of alcoholism and alcohol counseling.

These activities will contribute to the creation of an overall curriculum plan, plus some of the courses and materials to be used in implementing that plan. The methodology for writing the materials is a modified version of information mapping. This approach to technical writing was invented by Robert Horn and his colleagues in the late '60s and early '70s. Information mapping makes it possible to modularize the materials down to the single concept or to the one-page level. The resulting document is similar in structure to Hypertext, although it is not stored and retrieved by electronic means. The manuals produced by information mapping allow learners to have more control over their learning process in that they can move from one piece of information to another in a non-linear way, thus filling gaps in their knowledge as they discover them.

By the end of this project, several thousand such information maps will have been written, and this material will cover most of the basic competencies needed by substance abuse counselors.

Project staff are also exploring electronic storage and dissemination of these information maps with their network structure. Eventually, it may be possible for users to access training or reference materials through an online system using actual Hypertext software or something similar.

It may take a year or two to develop a prototype for field testing. As a research element within the project, this effort could be particularly important because it may result in an online learner-controlled teaching system that could become a model for adult-vocational education and training systems of the future.

Automated Job Aids For Instructional Design & Development: Can Relational Databases Cut Costs?

Michael J. Olson *

Why Use A Database?

Instructional development is expensive, particularly where multi-skilled teams are needed to produce computerized training systems. The literature reports that costs of instructional design alone account for 14% of the overall costs of development (Bernstein et al., 1987). For computer-based instruction (CBI), development ratios have ranged from 1 to 4000 hours of development for every hour of instruction (Orlansky, 1979; Jay, 1989).

The reasons for high costs are varied; most are situationally dependent with a wide range of variables. One of the more mundane problems a development team faces is transferring data from one format to another to build up and track information through different development phases. Changes caused by a terminology shift as well as changes in the target system configuration can cause considerable "breakage" in instructional materials and related documentation. On large multi-expertise teams, even trivial problems caused by nuances in acronyms, abbreviations, or the meaning of verbs in objectives can introduce expensive rework.

Projects with long development schedules also have personnel turnover problems; inexperience compounds the data consistency problem during development and evaluation cycles. A database, however, should make staff more efficient over time. Productivity increases whereby key people yield valuable time savings and schedule relief throughout the development process. Another common, expensive problem in large projects is the tendency for production teams to redo the technical content work completed by subject matter experts during earlier phases; a database should reduce such unnecessary rework (Gibbons). In the final report of a study focused on cost factors in CBI development, revisions and the lack of clear specifications were cited by 166 developers as the two most significant problems affecting costs (Bernstein et al., 1987). A good relational database management system (RDBMS) attacks these problems directly and forces a systematic approach to development. High costs of development have spurred interest in software tools to reduce costs and increase standardization (Reakes, 1989; Samuelsson, 1989). Government R&D proposals (e.g., as published in the Commerce Business Daily) report interest in expert systems or automated tools, which can aid inexperienced designers with the complex process of instructional design and can help subject matter experts with design tasks (Maxey, 1989; Olson, 1990). Evidence of interest in automation is easily found by scanning topic headings and abstracts of annual professional conferences, e.g., the Society for Applied Learning Technology's conference "Development of Effective Interactive Instruction Materials" (Cox & Cox, 1989; Cross et al., 1989).

There has also been a strong interest in intelligent tutoring systems with their capability for individualizing instruction, as well as related authoring systems. David Merrill at Utah State University, for example, in conjunction with Media Share, Inc. and various government research agencies, has been developing software that operationalizes ID2, or Second Generation Instructional Design. This software, called ID Expert, is directed at improving the development of interactive instructional materials by "guiding instruction to teach integrated sets of knowledge and skills...producing pedagogic prescriptions...and selection and sequencing of instructional transaction sets..." (Merrill, 1989).

Expert systems also require knowledge acquisition; no matter how expert the capabilities of an expert system are, raw content data must still be defined, refined, input, and represented by people. The "GIGO" problem (garbage in, garbage out) will not disappear with a database or an expert system; sloppy use can exacerbate the problem. A database system, however, has an inherent advantage over expert systems; RDBMS software is designed to optimize the procedural tasks of data input, search, storage, and change while in an expert system. These tasks require custom programming and laborious manual editing of code; therefore expert systems are notoriously clumsy vehicles for processing lexical data. Database systems are readily "learnable" by people who have to input data. Expert systems designers, on the other hand, are people with very hard-to-find skill

The methodologies for collecting data during instructional systems development are proven and have been

around for years; what has been missing is a practical, comprehensive database tool to collect this basic, content defining/limiting knowledge. This knowledge includes such items as lists of tasks, systems, knowledge and skills, objectives, task factors, curriculum/course outlines, lesson specifications, and scripts. Relational databases are a natural host for this information and should be considered an essential component for any CBI authoring system, expert system shell, or even a custom intelligent tutoring system. Inasmuch as database technology is here today, this approach offers the opportunity for CBI developers to be ready for importing data to expert systems once the latter are mature enough to be released to consumers (Olson, 1990).

The classic "non-linear" systems models used for instructional development all stress iteration among phases on the theoretical (and accurate) premise that feedback among steps followed by revision are essential ingredients of instructional design models (Trimby & Gentry, 1984). Iteration can be viewed more simply: as analysts delve more deeply into a problem they get smarter and have to fix things that get "broken." Personal experience of the author has shown that top level managers are suspicious of claims of the "developers' need to take feedback and return to an appropriate earlier phase to refine assumptions made when less was known about the content"; such statements tend to create the impression that the job was not done right the first time. Given the costs implicit in revision, this negative impression is not a completely unwarranted suspicion even if this same management initially refused to invest adequately in analysis, design, and specification.

Because of the difficulty and costs of manually documenting analysis, the goal of true iteration is difficult to achieve on complex, multi-year development projects. Databases, however, provide a practical means to update and maintain data, making iteration a viable and cost- efficient part of the development process. Ultimately, a good database system should facilitate producing consistent output, augmenting technical skills, and protecting data. Relational database systems are a proven technology and can be used as a practical, "non-expert" job aid which helps instructional designers produce instruction that is "good, fast and cheap" (Doughty, 1990) in data-intensive training environments.

When is a Database System an Appropriate Tool?

Relational databases are not for everybody all the time. The cost-effectiveness/suitability decision a manager must make before implementing a training database system boils down to assessing the core issues of volume, organizational impact, and accountability of training. The volume issue deals with distribution, retraining, customized training, and depth of jobs. A sophisticated database could be a cost-effective solution either where there are many different job classifications in a range of content areas or where the training target is complex (depth) and constantly evolving. If an organization is facing a major systemic change such as a plant upgrade or the introduction of a major system platform (e.g., aircraft) on a reasonable schedule, a relational database may be a viable tool. On the other hand, for unique training projects on a tight schedule, a database may not be a good short-term solution unless staff members are already an experienced and cohesive team working with a familiar, stable, normalized database system.

High accountability training is a rich justification for a database system regardless of data volume issues. The capability to map a trainee to systems and performance requirements is a *sine qua non* for pilot training, nuclear plant operation, weapons systems, process control, or marketing/sales areas. An organization's motivation to produce high-quality training in these situations is often very high.

Because a sophisticated database system brings with it an implied organizational/methodology change and related costs, the factors that make the expense practical must be considered carefully. An organization should not only quantify potential return-on-investment goals. It must also be prepared to have a change-agent committed to bringing a database into use within the organization. In addition to investments, there are noticeable recurring costs in implementing database systems. A complex database that will be tracking millions of data items will probably require a networked environment of powerful computers, a staff person to act as database administrator (DBA) and a small core of instructional designers/developers who are proficient database users.

The underlying capability of the host kernel (software program) to manage and control data is a critical technical issue. Not all kernels are created equal in this regard. Security of the data from loss, read/write controls, password protection, portability between platforms, and statistical processing/analysis are capabilities that are not uniform among kernels. The most "easy-to-use" database system may have weak data management and control capabilities or other limitations not immediately obvious to the buyer. Such limitations may be counter-productive to the intended function of the database and may risk the investment made in the data.

What are the Saving/Benefits of an RDBMS?

Risk factors examined by standard cost-analysis procedures in estimating development costs typically include: reliability/stability of documentation, skill of staff, schedule urgency, personnel loading, availability of experts, scope and difficulty of the effort, political/institutional stability, client relationship, and project goals (Kearsley, 1982; Mikos, 1987, 1988; Casey, 1988; Head, 1987). Estimates of savings from implementing any RDBMS must include the impact of implementing a systematic development process. An organization that does not currently use a sound Systems Approach to Training (SAT) model will experience far greater savings than one which has well established methods and experienced teams; the former organization will not be able to sort out savings that are directly attributable to the RDBMS.

Figure 1 represents a conservative estimate of savings that might be achieved in a hypothetical worst-case situation with a specific RDBMS. The recommended method to arrive at an estimate for the feasibility of the database and the break-even point is to estimate development variables normally, that is, to give particular attention to deriving a detailed assessment of all risk factors and multipliers at as great a level of detail as the schedule will allow time to generate. A conservative view of the savings can be produced by reducing the risk factors (those that can be quantified as a percentile) by the numbers indicated in Figure 1. The difference between investment/operation and risk reduction is the net estimated costs avoided. Only time will prove the reliability of these broad estimating guidelines.

FIGURE SAVINGS WITH TRACE
ESTIMATED EXPENSE REDUCTION

ANALYSIS, DESIGN, & DOCUMENTATION COSTS	- 50%
DEVELOPMENT COSTS	- 30%
IMPLEMENTATION COSTS	- 10%
REDEVELOPMENT COSTS	- 40%
RECURRING COSTS	- 30%

Figure 1.

An organization may wish to consider the alternative of building their own database rather than purchasing an application. Defining the requirements and performance needs for a new database application is far more costly than the application development process itself. Many of the costs can be attributed to the repercussions and changes to processes and procedures caused by installing applications. Organizational turf battles and in-fighting over approaches are frequently the biggest cause of the application development expense (Atre, 1980). In the author's opinion, purchasing almost ready-made applications will be more cost-effective and be a source of less vituperation or delays than building a home-grown system.

Somewhat analogous to the problems in predicting cost-effectiveness of media alternatives, the cost-effectiveness of using relational databases will be difficult to substantiate without prior cost histories in a training organization. Post-implementation evaluation should be planned. It would not be unreasonable to expect that the full benefits of using a database system will be quantifiable only after several years of experience with the database. Then the organization will have the ability to look at the real bottom line as well as student-unit hour costs, volume changes, and overall corporate profitability.

What is TRACE?

TRACE, an acronym for "Training Requirements/Attributes Concurrence Evaluation," is a sophisticated tool which automates the input, processes, and output of instructional systems development (ISD) data, and addresses the problems and issues stated herein. This RDBMS provides a means to define training device requirements, locate training materials affected by system upgrades or configuration changes, and track commonalities, including single-source identification of training materials across multiple training programs. TRACE is designed to process, correlate, and control millions of data items, particularly in operations and maintenance training environments. This RDBMS helps manage inventory, projects, source documentation, and the data itself; it is a tool for automating the Systems Approach to Training, or the ISD process. A reasonable expectation is to achieve 10% to 30% reductions in the life-cycle costs of training.

How Does TRACE Work?

TRACE has five modules supporting the needs of instructional design, as well as a set of management and development tools (see Figure 2). Analysts develop a model of the physical structure of the target hardware/software system, down to function numbers (symbol designators), names, and part numbers. Training requirements and proficiency objective measurements are correlated to the hardware/software/content structure. Once a population group's ability to meet proficiency objectives has been analyzed, the user can organize objectives into curriculum structures, define instructional treatments and media, and conduct a cost-analysis. Lesson/Element Specifications define

instructional treatment packages for teaching the objectives incrementally, the final treatment being a proficiency test. A Lesson Specification report outputs all relevant data collected in previous modules (e.g., descriptions of equipment collected during the systems analysis). An inventory module maintains records on training materials used to support execution of training programs. TRACE has a variety of management adjuncts for planning, establishing milestones, and the status of any training system activity (such as planned and actual completion dates and individual responsibility). The user can identify and qualify the input or reference sources for all data, including documents, experts, or system tests, and changes in versions of data. Special tools enable anyone with word processing skills to prepare data by working with ASCII files, including selecting data from ASCII versions of technical manuals for bulk input into the database.

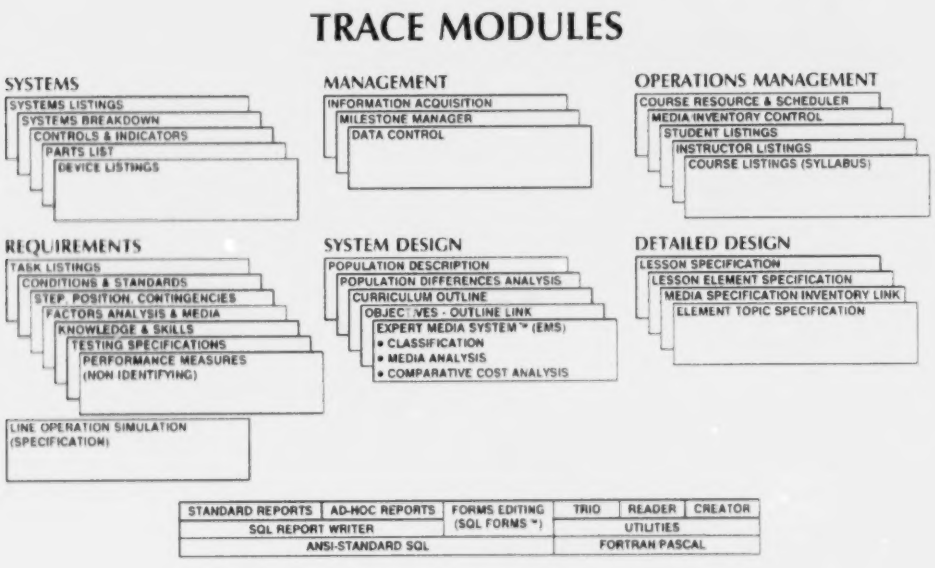

Figure 2

Who is Using TRACE, and for What?

Delta Air Lines is the first site to use TRACE. Delta has two primary reasons for going to a database system. One reason is to respond to a new FAA option called the Advanced Qualification Program (AQP). AQP allows airlines to reduce training pipelines and take advantage of new training technology, provided they can verify that all training requirements are being met. The other reason is to reduce training expenses and improve the skills of pilots. Each year Delta provides two ten-day recurring training sessions for its 8,000 pilots; the goal is to eliminate one of the training sessions and reduce the number of days spent in recurring training. By systematically focusing on quantifiable factors and identified training needs it will be possible to eliminate unnecessary training. Although initially the system will be used for pilot training, Delta is aware that substantial portions of their analysis work (systems data and task lists) are transferrable both among aircraft and to maintain training projects as well. Delta expects that using TRACE and the systems approach to training will reduce their expenses by a significantly greater margin than the estimates in this article.

Another project in substance abuse counselor training is beginning at Syracuse University's Training Systems Institute under a contract from New York State. Trace Technologies will participate in this contract from an R&D standpoint to evaluate the methodology and data processing requirements made on a database for a soft-skills training problem. This project is starting with a curriculum upgrade focus (instead of task or systems analysis) where the product will be materials developed in accordance with information mapping techniques. Initially TRACE will be used to track interrelationships of the maps and eventually will be correlated to specific drug counselor competencies. This correlation should allow the production of custom courses based on an individual's actual abilities.

Conclusion

Initial use of a database system may increase investments in collecting data that have previously been ignored, postponed, or avoided in the early stages of the development process. Databases are built to find and change data rapidly. Noticeable savings will be realized whenever there is a change in the target of training, such as an update to the target system caused by an engineering enhancement; in this case all training materials affected by this change can be found with a simple database query. In the long run, investment and recurring costs of designing, developing, executing, and maintaining training programs will go down when well-organized relational databases are introduced into training development organizations.

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Job-Aids

*Alex Romiszowski**

Introduction

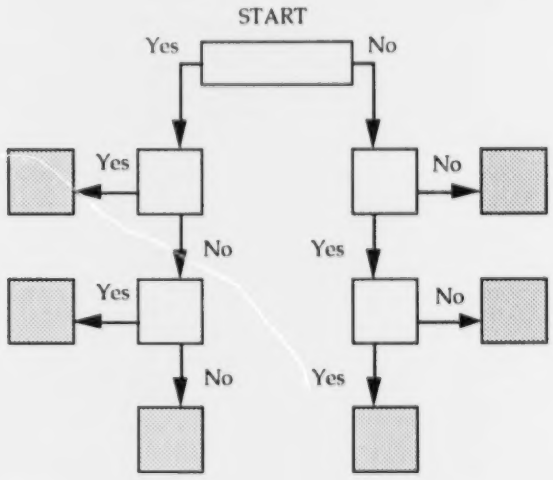
In this issue, the job-aids section is devoted to feedback and discussion of the exercises and problems presented in previous issues. In Vol. 1, No. 1, we posed two problems for discussion, concerned with the presentation and visual layout of job-aids. In Vol. 1, No. 2, we presented an exercise on the topic of Structural Communication. The reader may wish to refer to the two earlier issues while reading the following article.

1 Job-Aid Presentation (Vol. 1, No. 1, Map 3)

Two problems were posed in the first job-aids section. Both were concerned with aspects of the organization and presentation of a procedural job-aid to the user/learner.

1.1 Alternative Presentation to Flow-Charts

Several readers submitted ideas on the restructuring of the two job-aids presented as flow-charts in Figures 1 and 2 (Vol. 1, No. 1, Map 1). Some of these maintained the flow-chart presentation, but reorganized the page layout in an attempt to improve clarity of communication. For Figure 2 (the Capital Gains Tax example), a layout as indicated by the following diagram was suggested.



The content of the boxes would be identical to the original flow-chart. This reorganization attempted to "chunk" the cases where tax has to be paid (to the left), where tax can be deducted (to the right), and where there is no tax issue (to the bottom). The reader also suggested repeating essentially the same outcome box (at the bottom) twice in order to avoid the visual effect of two arrows entering the same box possibly confusing a user who is not very skilled at reading flow-charts. Those with an eye for visual presentation might like to compare the above schematic with the one published in Figure 2 of Vol. 1, No. 1, Map 1. Is any communication benefit likely to be achieved? Are there any other visual/layout changes that might improve communication?

A larger group of readers abandoned the flow-chart presentation altogether, on the grounds that most potential users may be unfamiliar with the presentation conventions and may therefore have difficulty in interpreting the flow-charts. The preferred alternative was the IF-THEN chart. Here is a typical example. Note that the language has, once more, been kept very close to the original version.

	IF	THEN
1	Selling Price greater than Market Value AND Market Value greater than Cost Price	Tax charged on Selling Price less Market Value, less Expenses
2	Selling Price greater than Cost Price AND Cost Price greater than Market Value	Tax charged on Selling Price less cost Price, less Expenses
3a	Selling Price greater than Cost Price AND Market Value greater than Selling Price	No Tax either charged or allowed
	or if	
3b	Selling Price greater than Market Value AND Cost Price greater than Selling Price	
4	Market Value greater than Cost Price AND Cost Price greater than Selling Price	Tax allowed on Cost Price less Selling Price, plus Expenses
5	Cost Price greater than Market Value AND Market Value greater than Selling Price	Tax allowed on Market Value less Selling Price, plus Expenses

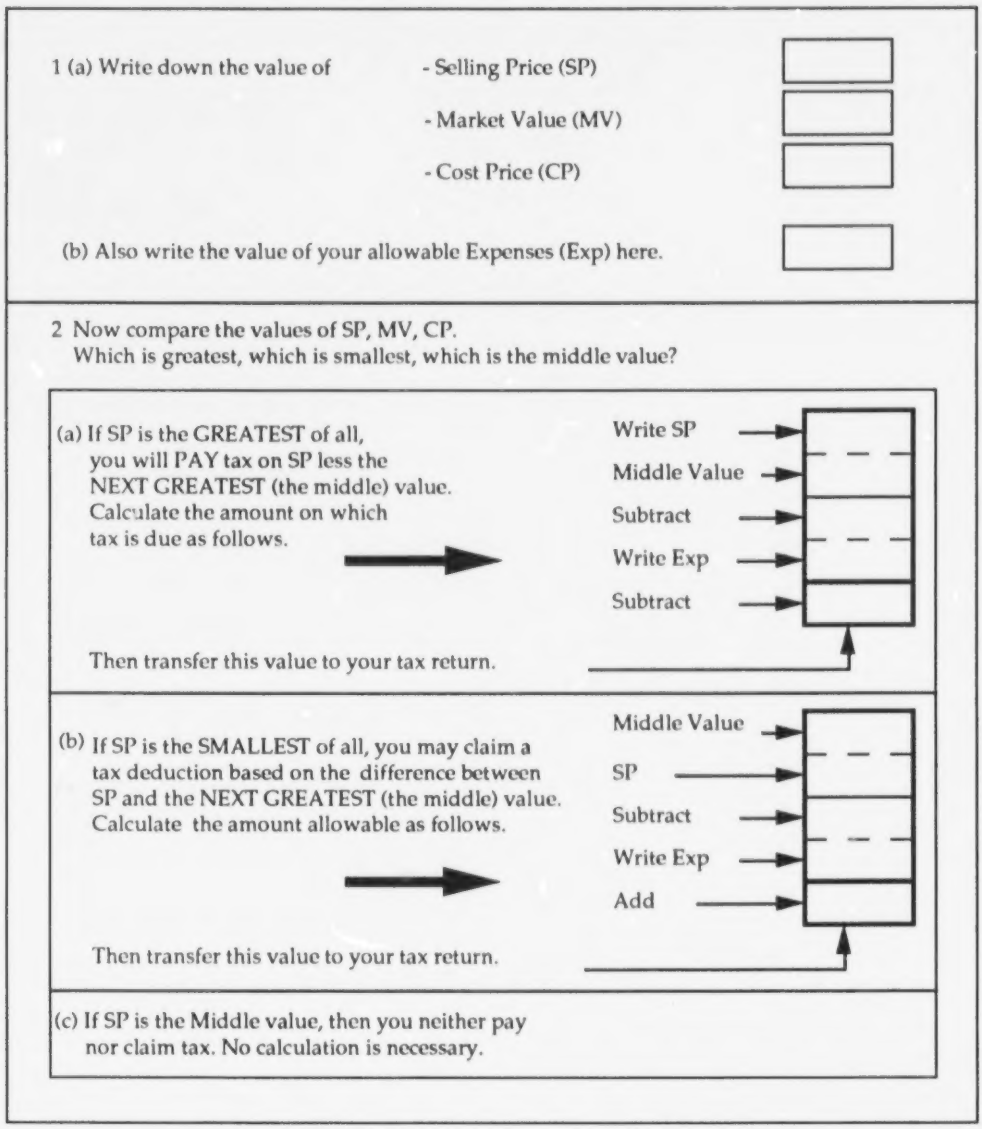
The authors of this version of the IF-THEN chart argued for the use of full sentences (as in the original) and for repetition of phrases, so that each of the condition-outcome rows of the table are self-sufficient. This version requires little knowledge of special visual communication languages/conventions, but good verbal comprehension skills. Some other readers submitted similar IF-THEN charts, as regards the decision structure, but used simplified language/abbreviations/mathematical symbols. For example:

1	If SP>MV>CP then pay on (SP-MV-Exp)
2	If SP>CP>MV then pay on (SP-CP-Exp)
3a	If MV>SP>CP } then no tax to pay or claim
3b	If CP>SP>MV }
4	If MV>CP>SP then claim on (CP-SP+Exp)
5	If CP>MV>SP then claim on (MV-SP+Exp)

Naturally, it is assumed in all cases that the decision-making job-aid is preceded by clear and effective definitions of the terms Selling Price, Market Value, Cost Price, and Expenses as they relate to the particular case of Capital Gains Tax.

No reader went so far as to change the style of the job-aid completely. Yet this is possible. By studying the symmetry of the flow-chart, or of the IF-THEN charts, one notices that the value of the Selling Price, in relation to the other two values involved, is the key to the whole exercise. It is obvious why this should be so, even without full knowledge of the tax laws upon which the example is based. When the Selling Price is GREATEST, you make a profit, and when it's the SMALLEST of the three, you have a loss and may expect to claim it on your tax return. That can be explained in one sentence (as I have just done). What remains is to explain how to evaluate the amount of tax to pay/claim.

This example may seem a bit more complex than the earlier charts. On the other hand, it does two things the earlier charts did not: It imparts some understanding of the rationale for the procedure, and it presents a work area for the calculations, which eliminates the need for the user to interpret a verbally stated math problem.


1 (a) Write down the value of
- Selling Price (SP)
- Market Value (MV)
- Cost Price (CP)
(b) Also write the value of your allowable Expenses (Exp) here.
2 Now compare the values of SP, MV, CP.
Which is greatest, which is smallest, which is the middle value?
(a) If SP is the GREATEST of all, you will PAY tax on SP less the NEXT GREATEST (the middle) value. Calculate the amount on which tax is due as follows.
Write SP
Middle Value
Subtract
Write Exp
Subtract
Then transfer this value to your tax return.
(b) If SP is the SMALLEST of all, you may claim a tax deduction based on the difference between SP and the NEXT GREATEST (the middle) value. Calculate the amount allowable as follows.
Middle Value
SP
Subtract
Write Exp
Add
Then transfer this value to your tax return.
(c) If SP is the Middle value, then you neither pay nor claim tax. No calculation is necessary.

Now let us move on to the other job-aid that readers were invited to redesign: the flow-chart to assist a player of TIC-TAC-TOE never to lose a game, shown originally in Figure 1 (Vol. 1, No. 1, Map 1). Some readers commented that the flow-chart format is the ideal one in this case, due to the recursive or "looping" nature of the procedure. The flow-chart demonstrates this clearly, with an economy of words. Some, however, attempted to construct an IF-THEN chart. The best one, which looks more like a higher-order computer-language program than a "classical" IF-THEN chart, is reproduced here. It appears to have some communication advantages: It does not rely on flow-chart reading skills; it clearly separates that part of the procedure which is specific to the first move from that part which is recursive. But many prefer the spatially laid out flow-chart. It can be taken in at a glance; it seems to better portray the dynamics of the game; and it does not introduce a perhaps unfamiliar "IF-THEN-ELSE-GO-TO" convention. Any further observations? Perhaps some readers have yet further criticisms or bright ideas for improvements of what we have presented here.

First Move	1.	Wait for opponent (X) to make the first move.
	2.	IF X occupied the center square, THEN place O in any corner and GO TO 5.
	3.	IF X occupied a corner, THEN place O in the center square and GO TO 5.
	4.	IF X occupied the middle of a side, Place O in either of the two corners next to X and GO TO 5.
All Subsequent Moves	5.	Wait for X to move. IF X has 2 crosses in a line with the 3rd square vacant, THEN prevent X from winning by placing O in 3rd square and GO TO 9, ELSE GO TO 6.
	6.	IF the center square is still vacant, THEN place O in the center square.
	7.	IF only 2 vacant squares left, THEN place O anywhere you like and GO TO 11, ELSE GO TO 8.
	8.	IF there is an X in the center, THEN place O in any vacant corner, ELSE place O in any square adjacent to the square in which X has just played.
	9.	IF no vacant squares left THEN GO TO 11, ELSE GO TO 10.
	10.	IF you can get 3 O's in a line, THEN make the winning move and GO TO 12, ELSE GO TO 5.
	11.	The game is over and is drawn.
	12.	You have won the game.

1.2 The computer-based storage and presentation of job-aids.

The second problem, posed in the first job-aids issue, did not produce as much correspondence as the first one, which we just discussed. Few readers commented on the questions when/how/why computer-based job-aids are preferable to simple paper-based ones. Those who did comment focused on the aspect of complexity—complexity of interrelated, interdependent factors to be considered; complexity of the process of calculating a result (complex weighting, probability factors, formulae, etc); and complexity of note-taking; as well as sheer number of questions to ask and sheer size of flow-charts or checklists if presented on paper. To summarize and extend these reader comments, I will embed them in a short case study of computer-based and paper-based job-aids.

Among the examples of job-aids included in Vol 1, No. 1, there is a "weighted checklist," or questionnaire, that presents a series of questions to help the reader decide whether computer-based training (CBT) would be an appropriate choice for a given course. This two-page questionnaire was prepared by an IDD&E graduate student, Shih-Shien Chang, by analyzing a section of a commercially available "expert system" (CBT Analyst, published by Park Row Software, 1986). The software itself is based on the expertise contained in a book (Computer Based Training, by Greg Kiersley, Addison-Wesley, 1984). The software has five sections, or chapters, dealing with aspects of CBT projects, such as costs and evaluation, as well as a section on "Selecting a Course for CBT," which was the basis for our checklist. The checklist, and the computer-based version of it, are summaries of the original book, which is itself the summary of the expertise, or the informed opinions, of one instructional design professional (the book's author).

The question is, What would other, perhaps less well-informed, professionals find most useful to assist them in making the decision whether to employ CBT for a given course they are developing? The computer-based decision-making software? The paper-based, two-page weighted checklist? The original book with its detailed explanations? The book plus the software package? The book plus the checklist as an appendix? Answering this question is not as easy as it may seem. If "find most useful" is interpreted in *behavioral* terms, then we must discover what such professionals will actually use as a job-aid and what they will reject. An opinion survey of a group of IDD&E students who used both the computer-based and the paper-based versions of CBT Analyst revealed that about half preferred to use one and the other half preferred the other. All the students, however, said they would like to read the original book to satisfy themselves that they understood the rationale embodied in the job-aid.

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If, on the other hand, we interpret "find most useful" in *performance* terms, then we must discover which of the alternatives leads to the most significant improvement in job performance, that is, under which conditions are "the best" decisions taken in respect of the utilization, or not, of computer-based training. Questions of both the validity and the reliability of the job-aid as a decision-making tool must be raised. The question of validity reflects both on the original expertise encapsulated in the job-aid and on the skill with which this expertise was "engineered" into the job-aid. We are touching here on the issue of "knowledge engineering," which is the identification of expertise, knowledge acquisition from the expert(s), and knowledge representation in a form that can be processed by computers (or, in our case, by less expert persons). Although validity is of fundamental importance, here we will concentrate on the question of how to present the job-aid to the user.

The question of reliability has two aspects: (a) How reliably is the decision-making process executed by the job-aid, once the necessary data on a specific case is provided by the user? and (b) How reliably is this basic information collected in the first place? The old adage "GIGO" (garbage in, garbage out) applies here too.

In relation to the first aspect, the computer-based version of the job-aid is, of course, 100% reliable in correctly computing the questionnaire score and presenting the appropriate recommendation. Our experience with 30 students using the paper-based version, each one dealing with four case examples (total of 120 cases) resulted in one instance of an addition error in the final computation, an error rate of less than 1%. However, replication of this study with a job-aid that involved a much more complex computation process than the simple addition required by CBT Analyst, resulted in a human error rate in computation and interpretation of the result in excess of 20%. Whereas a 1% human error rate may not justify investment in automation, a 20% error rate probably does.

Regarding the second aspect, we used four short cases, or scenarios, typical of situations in which a tool like CBT Analyst might be used. Each scenario briefly described a specific course and the context in which it was to be implemented, in sufficient detail to allow a reader to deduce the answers to the questions posed by CBT Analyst. For example, one scenario described a high school algebra course to be implemented across a large school district. The subject matter was stable, adequate course materials already existed, and the approximate number of students per annum who would take the course was known. Thirty graduate students of instructional design and development were asked to read each scenario and use one or another version of CBT Analyst (paper- or computer-based) to come to a decision on whether CBT should be considered a delivery medium for the course.

The results of the study were interesting. No great differences were found between the computer- and paper-based versions. Regarding speed of resolution of problems, some of the students were consistently faster on the computer-based version, but a similar number were consistently faster when using the paper questionnaire. Procedural and computational error rates were insignificant, as was mentioned earlier.

However, the reliability of the final recommendations did not seem to be very high. On each of the four case studies, there was significant variability in the final recommendations received from the job-aid. For one of the four cases, students received recommendations across the whole spectrum of possibilities, from "THIS COURSE IS AN EXCELLENT CANDIDATE FOR CBT" to THIS COURSE IS NOT A CANDIDATE FOR CBT." Given that this was not due to procedural or computational errors, it must be due to variance in the way that individual students responded to the 16 specific questions posed by CBT Analyst. As all 30 students were working from the same cases, their interpretation of these scenarios must have varied considerably. The scenarios were written in such a way as to replicate the amount of interpretation of given data that is typical in a real-life setting where instructional methods and media decisions are taken.

Similar results have been observed in the field testing of other expert systems. These observations suggest that there is some serious rethinking to be done in relation to expectations of improved instructional designer performance when expert decision-making support tools are used.

My own feeling is that the tools are as yet unreliable, but are not useless. They should, however, be presented to the user as a "model to think with," rather than a "substitute for thinking." The presentation of a simple—not necessarily complete or comprehensive—checklist in the guise of an "expert system," with all the mystique that computer presentation may have for some users, is perhaps a disservice. This is not to argue against the presentation of an instructional design decision-making tool by means of a computer. It is rather to question how one designs and presents the tool. A more transparent presentation, showing the checklist for what it is , may be better. A more thorough back-up of the checklist, with fuller discussion of the rationale behind the questions, may improve reliability by eliminating misunderstandings on the part of the user. Before we know it, we are creating a hypertext version of a book on the expert domain, rather than substituting for the book an unreliable expert system. Please send us any comments you may have on this issue.

2 Structural Communication (SC)

In Vol. 1, No. 2 of Instructional Developments, the job-aids section was devoted to describing the potential use of Structural Communication materials in education and training. An example of the method was included, adapted from an exercise first published by Kieran Egan (1976). A discussion of one of three problems was presented as an illustration of the method in action. A response coupon was included, so that interested readers might try their hand at the exercise, mail in their responses, and engage in a distance-seminar on the topic. We present here the comments and the discussion guide for Problems 2, 3, and 4. In this exercise there are no absolutely correct or incorrect responses. Rather, we are exchanging viewpoints on the topic of SC and its potential for implementing some of the currently fashionable cognitive-psychology-based instructional principles in practical and simply-developed self-instructional materials.

Readers should refer to the Job-Aids section of Volume 1, No. 2, before reading on. You may wish to review the descriptions of SC presented in Maps 1 to 4. Then, in Map 5, four problems are presented. All can be responded to in a very open-ended manner, by use of some combination of some of the 24 items in the Response Matrix. The discussion of Problem #1 was presented in Volume 1, No. 2. We now discuss the other three problems.

The Discussion Guide presented here will guide the reader through the ensuing Discussion Comments. However, we strongly recommend that you make your own response to the problem before proceeding on to the Discussion.

Problem #2 Discussion Guide

IF YOU	THEN YOU MIGHT WANT TO READ
INCLUDED any three or more of 6, 7, 8, 9, 11, 12, 14, 15, 16, 17, 1, and 24	COMMENT G
OMITTED any two or more of 4, 5, and 23	COMMENT H
OMITTED 2, 13, or 21	COMMENT I
INCLUDED any two or more of 1, 3, 10, and 20	COMMENT J

Problem #3 Discussion Guide

IF YOU	THEN YOU MIGHT WANT TO READ
OMITTED 3, 15, or 22	COMMENT K
OMITTED 9 and 24	COMMENT L
OMITTED 12 and 17	COMMENT M
OMITTED any two or more of 2, 4, 5, 13, and 17	COMMENT N
INCLUDED more than two but less than six of 1, 6, 7, 8, 10, 11, 13, 14, 16, 18, 19, 20, 21, 23.	COMMENT O
INCLUDED all the items	COMMENT P
OMITTED all the items	COMMENT Q

Problem #4
Discussion Guide

IF YOU	THEN YOU MIGHT WANT TO READ
OMITTED 1, 3, 11, 19, or 24	COMMENT R
OMITTED any two or more of 2, 8, 7, 12, and 20	COMMENT S
OMITTED 15 and 18	COMMENT T
OMITTED 14	COMMENT U
INCLUDED any three or more of 4, 5, 9, 10, 17, and 22	COMMENT V
INCLUDED any two or more of 6, 16, 21, and 23	COMMENT W

The feedback comments (G to W) which follow, were written by Kieran Egan for the original 1976 presentation of this exercise. Comments A to F, which refer to problem #1, have already been presented in Vol. 1, No. 2 of this journal. Readers may note how the same item from the response matrix may figure as part of a valid response for more than one of the problems posed. However, the inclusion or omission of this item generates different author comments depending on the problem. This illustrates the structural nature of the communication process that this technique generates—hence its name.

Discussion Points

G. Well, if you've been directed to this comment, I suppose the wording of the problem cannot have been precise enough. I wanted to distinguish between the contributions that SC can make to the kind of intellectual activity that a teacher would be happy to encourage in class, and its more practical or technical contributions to allowing greater flexibility in organizing the structure of the classes. I admit this isn't too clear, or realistic, a distinction; the kinds of intellectual activities made possible will have implications for the way the teacher will organize lessons. But this problem is concerned less with the characteristics of the technique that may indirectly affect class structure than with those that offer direct possibilities for various kinds of organizational strategies. Look again at the response matrix and omit from your response those items that don't suggest immediate strategic advantages for the teacher, then recycle through the discussion guide.

H. Certain strategic advantages result from the "economy" of SC's form. SC units permit various kinds of educational functions to be performed more or less simultaneously; a unit may engage the student in role playing and, while he learns from simulating some educationally significant task in a structured format, the teacher may diagnose from the record of his responses something about his rate of progress, his learning style, his areas of misunderstanding, and so on. This economy of function, combined with an in-built motivating form, recommends SC to teachers.

If you have been guided to this comment after rigorously pruning from your response all merely indirect contributions to SC's ability to aid the teacher in planning classes, you may feel that I am arguing for things that are no more direct than some of the items you had included earlier. The line separating direct from indirect in this context is not all that sharp, of course, but I'd want to draw it about the point represented by the combination of items 5, 13, and 24.

I. Programmed Instruction is a tool that can help ease the pressures of teaching thirty or more students in a class. Students who are behind or ahead of the rest of the class can work by themselves, using programmed materials. SC is an even more valuable tool for such circumstances. Being self-contained, a study unit may be used by individual students as desired. Because of the potential for fruitful group work, it is possible to break the class down and have a number of groups working on the same, similar, or different materials—whatever suits their needs. SC has the further advantage of being dissectable; that is, the teacher may decide to give only the problems and matrix to some students, covering the presentation and discussion in class in her own way; or she may give the presentation and problems, or the problems, matrix, and comments in preparation for a more detailed class discussion, and so on. This versatility of SC adds to the strategic possibilities open to the teacher.

J. I would omit from my response to this problem items that offer only indirect advantages to the teacher who is planning classes. Hopefully, all the items in the matrix would be reasons why teachers might want to use SC. Here, though, we are concentrating on those factors that contribute directly to the range of strategic possibilities opened to the teacher in planning the form of a class. Take a more rigorous look at the items you have selected and see whether you might not want to drop a couple on the grounds of indirectness. That SC can focus thought on relevant material, measure certain intellectual skills objectively, and diagnose student responses to reveal misunderstandings and biases, I would tend to consider just over the boundary of direct contributions. Maybe that's too harsh. I guess this would be rather a disagreement about the interpretation of the problem than about SC as such.

K. I know of no other technique that allows the student such freedom in responding and yet so precisely controls his progress from that response to reinforcing, corrective, or other material, while continuing to build an unambiguous message. Nor do I know of any technique that at the same time allows the potential for reliably measuring sophisticated intellectual skills. These seem to me to lie at the heart of SC's uniqueness. It would probably be idle to offer any further argument for these points—that uniqueness has been both the reason for and the subject of this book. Counterarguments, if you disagree with me, must come in the form of examples of other means of achieving these ends. If they exist, I don't know about them.

L. I think SC offers a means both of getting the student to replicate the author's understanding of a topic, and also of allowing a comparison of the student's and author's understandings. Comparing may be one of the steps toward achieving the replication, especially if discussion and recycling the student through the matrix a number of times is necessary.

Of course this process can fail, and often must. You may think that the terms, "replicate" and "compare" are too strong, suggesting more than the technique can possibly achieve. Maybe. However, I don't know what terms would be more appropriate. Only if we insist on a strict interpretation of the terms would I concede their inappropriateness, and I think my use of them here is fair: the structure the successful student composes will be like that built by the author into the structuring of the unit; it will reflect his own understanding of the topic. The discussion guide and comments allow a comparison of the student's understanding with the author's by clarifying how certain terms are used—as here—or what additional items are required, how items are related, and so on.

I think that kind of replication of understanding is unique to SC. The comparison of author's and student's understanding is perhaps possible to achieve by other means, but certainly not with such economy of time and space.

M. The student responds by composing from a set of items, all relevant to the general theme, a set of inter-related subthemes according to prescribed viewpoints, ensuring thereby the emergence of the structure of the theme in the course of responding. This seems unique to SC. A talented teacher or poet might achieve the same end, but even that seems doubtful given the nature of the material with which SC is usually concerned. Certain concepts of chemical bonding seem rarely to have provided the inspiration for poetry. I wouldn't want to push this too hard, but I think these factors contribute to an understanding of SC's uniqueness.

N. The conciseness of SC makes learning experiences possible in a variety of situations. The flexibility of the technique's form, which allows sections to be detached,each making a different contribution to different activities, also makes it unique. A gifted teacher might duplicate these functions, adding that further flexibility only a live teacher can provide. But rarely does a teacher have time for this sort of interaction with individuals.

O. You have included a set of items here that seem somewhat over-generous to SC, or under-generous to alternative forms of programmed instruction, textbooks, or other means of teaching. Think of other modes of presentation at their best, then reassess your response. See whether you wouldn't lop off a few items.

P. Well, I can hardly agree with you. Of course, you are right that the full uniqueness of SC is to be seen in the combination of all the items. However, it may have been a more useful strategy on your part to be more selective and include in your response only the items that are particularly strong examples of the uniqueness of SC.

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Q. See comment P, to which those who gave exactly the opposite response were directed. We obviously have a	difference of opinion regarding the uniqueness of SC.
R. The kind of response made to an SC problem leaves a "trace," that is, the numbers corresponding to the set of items the student considers the best answer. This "trace" of his response allows us to draw certain inferences about his misunderstandings, his biases, his progress, his level of achievement, how well he is able to organize the material, and so on. By analyzing these, or preanalyzing possible	responses, we may prepare corrective or reinforcing comments; we may compare the student's understanding with the author's; we may produce scores which will be of value in making decisions about the student's future courses, etc. These advantages seem to follow directly from the kind of response SC calls forth.
S. The response left by the student makes a number of strategies possible for future work. It allows guidance of the individual student to further material for which his response indicates a need, or it can serve as a directing mechanism to a group discussion—in both cases probably leading the student(s) beyond the level of understanding achieved either from reading the presentation or from	working through the problems and matrix themselves. It does this by focusing more precisely on the relevant material and continuing to refine the discriminations the student was asked to make from the matrix. Without the record of the responses, these functions would necessarily be absent from the technique.
T. SC doesn't just allow a variety of response strategies to the student, it also allows the author to prepare a variety of response strategies to the student's response. This variety of ways of dealing with individual responses is important	for ensuring that the communication is achieved clearly and efficiently with as much richness as desired. The lack of the student's response would surely impoverish what one might securely communicate.
U. There is a degree of unavoidable ambiguity in constructing the items. If this were a teaching unit, I would use this opportunity to clarify my meaning and direct you through the matrix again with a clearer understanding of what each item signifies. The items are useful for communication only	when we are clear about their meaning. Without the recorded response this would be impossible in SC, and a whole dimension of precision would be lost. For this reason I consider item 14 essential to a response to this problem.
V. I think you are being either too generous to SC's response mechanism or are confusing the problem's requirements. We are concerned here with those activities or functions made possible by the kind of response that	results from working through the problems and matrix. Look again at your response and consider whether there aren't a number of items that really don't follow from having available a typical SC response.
W. You seem to have interpreted a number of items differently from me. As this isn't a teaching unit, I'm not very perturbed by this. I can see interpretations of the items that brought you to this comment that would make them appro-	priate, if somewhat peripheral, to building a picture of the advantages following from the response mechanism of SC. I guess this is a non-comment.

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Instructional Developments

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Instructional Developments
Volume 3 Number 1

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This is a double-size issue of Instructional Developments, covering two semesters of our work in the School of Education. As usual, it has two themes. Though not specifically related, these themes can be seen as complementary: one looks backwards reviewing the considerable contribution to our field of the work and writing of Professor David R. Krathwohl; the second looks forward in an attempt to see educational rhyme and reason in the latest technological bandwagons — multimedia and hypermedia.

It is most appropriate that we should devote one of our principle themes to the work of Dave Krathwohl, given that the publication of this issue coincides with Dave's retirement from our faculty, and also with the publication of his most recent book entitled: *Methods of Social Science and Educational Research: An Integrated Approach*. Dave has based the feature article of this issue on the organizing framework for this book, which views research as a 'chain of reasoning'.

Elsewhere in the issue, we present a review of this book, from the viewpoints of both student and professor. Another of Dave's influential books, dealing with 'how to prepare a research proposal' is also reviewed. To round off our 'farewell Dave' message we also include a short personal review by Charles Dills, of the influence of Dave Krathwohl's published works on students and researchers in the field of instruction.

Finally, still related to Dave Krathwohl's contribution to our field, Cheryl Ackerson analyses recent literature on instruction in the affective domain. She compares and contrasts two distinct strands discernable in the literature. One is a concern with the general climate of the teaching/learning situation and with techniques that foster a general positive attitude toward learning. The other is a concern with the attainment of specific affective objectives, related to the content or the overall goals of a given program. The first of these bodies of literature bristles with a variety of (conventional and unconventional) general suggestions on how to plan and implement a 'user-friendly' form of instruction. The second is more firmly based on systematic instructional design, development, and evaluation. In this area, the pioneering taxonomies of educational objectives and related evaluation methods developed by Benjamin Bloom, David Krathwohl, and their collaborators, still stand as cornerstones around which innumerable curriculum and course design projects are structured.

The second main theme of this issue is concerned with the emerging instructional technologies spawned by recent developments in computing and telecommunications. This is a theme that we shall develop over several issues. In this first part, we take a somewhat critical and questioning look at the new 'buzzwords' of 'Hypertext', 'Hypermedia', and 'Interactive Multimedia'.

First, Lydia Doty reviews some of the recent research on the use of hypertext in education. She compares the philosophical arguments for hypertext as a 'cognitively more appropriate' manner of presenting information (that reflects the way knowledge is stored in the human mind) with the pragmatic arguments for hypertext as an effective and efficient 'information management tool'. She notes that the current research base is inconclusive on both counts and proceeds to relate the hypertext literature to the other existing bodies of research on writing and rhetoric.

The Job-Aids section follows on by developing a meaningful structure for the many overlapping and much abused concepts that spring up in this 'new technology'. This leads into some suggestions on how to go about selecting and designing useful applications of Interactive Multimedia for education.

Research as a Chain of Reasoning[1]

David R. Krathwohl *

Several federal reviewers are chatting about journal articles that were final reports of projects they had funded:

"I had a hard time with that one. She started right off describing her data and it was only later that I learned how and where she had gathered it. In the end, she had answered all my questions, but I guess I have a set of customary expectations about how a report of research should be written. I'm surprised this journal permitted such a deviation."

"Move over, I have the same expectations, there are a lot of us in that 'rut.' I must say though, yours was an exception; that last one I reviewed was a dream. Everything was there and in good logical order."

"The report is the one thing for which we don't provide a standard federal form. I guess it is so the researchers are free to write their report in any way that makes sense to them. Sometime I wish we did enforce a particular sequence or outline, especially for those reports that are not in journal article form. It would make them easier and faster to read and critique."

"Whoa!! Come on now you don't really! There is more than enough bureaucratic regulation around here! Give them some freedom."

"Okay, I'll grant we don't want to stifle creativity. But most journals create expectations in their readers and authors that certain parts of the research will be reported in a particular order. I think we should too. It makes such good logical sense to build one's case that way."

"Yes, and if there are headings, one knows just where to look for certain items."

"Sure, but even without headings, the organization of the write-up provides an orderly sequence so one can follow the argument and find what one needs."

This conversation simply reinforces the fact that research is a social process; the researcher is communicating with her audience to properly convey the study and how carefully it was done. Similarly, the reader or reviewer is trying to follow it: raising and answering questions as the report is read, judging whether it does indeed support the knowledge claim that is being asserted. It is not surprising therefore that a rather standard form or sequence of presentation has evolved. The standard has been informal, and accepted by authors, instead of being required by journals; though some journals rarely seem to depart from it. Depending on the journal's past record, it may be expected by reviewers.

Articles that present a research-based knowledge claim for a generalization are typically presented as a logical argument. Its parts correspond to what might be thought of as a prototypical or model chain of reasoning. That chain of reasoning applies to any research article, however. Even if information is not presented in the usual order, all the parts of the chain are required to supply adequate information to make the case. One may ask, "Is this true even of qualitative research studies which use an inductive method to gather and analyze their data?" If the purpose of the study is not mainly description, but that of presenting and supporting one or more generalizations, then a qualitative study is usually presented deductively. A picture of the chain of reasoning appears as Figure 1.

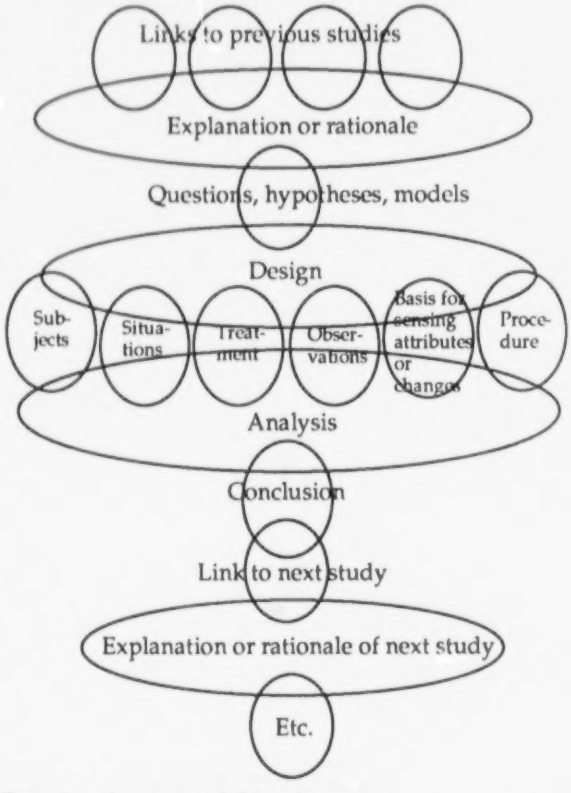

Figure 1: A prototypical chain of reasoning

This chain of reasoning serves as a general model of the logical argument. To make the research chain of reasoning more than an abstract conceptualization, let us see how it applies to an experiment. In the case of an

experiment which is usually planned deductively, we can examine it as a model both for reporting and for analyzing the choices available at each link in the chain.

The Chain of Reasoning Applied to an Experiment

Consider the example shown in Figure 2 adapted from Krathwohl (1985). The research literature suggests there are naturally occurring zones of activity in the classroom normally occupied by high achievers. The rationale for the study which grows out of this literature is that maybe this phenomenon could be turned into a treatment for those who achieve poorly by placing them where high achievers normally sit.

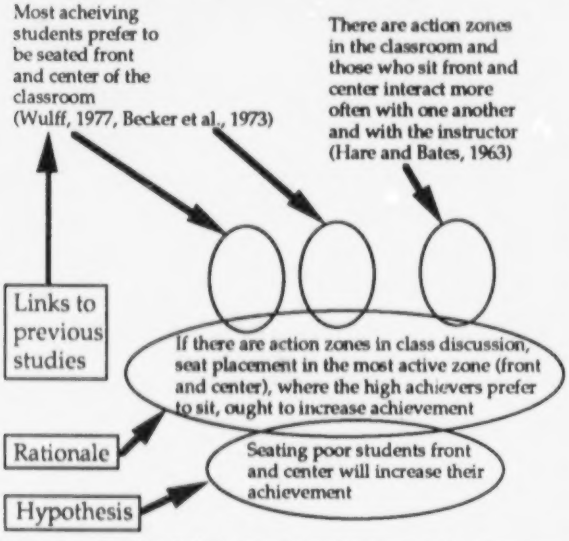
Most acheiving students prefer to be seated front and center of the classroom (Wulff, 1977, Becker et al., 1973)
There are action zones in the classroom and those who sit front and center interact more often with one another and with the instructor (Hare and Bates, 1963)
Links to previous studies
If there are action zones in class discussion, seat placement in the most active zone (front and center), where the high achievers prefer to sit, ought to increase achievement
Rationale
Seating poor students front and center will increase their achievement
Hypothesis

Figure 2: The first links in the chain of reasoning of a classroom seating placement study

Where this is an already published study, the choices in the chain of reasoning would seem obvious—easy ones to make. Like looking through binoculars focused on a particular phenomenon, one's attention is circumscribed and limited to the characteristics of the study as reported. But, when you turn the binoculars around and look through the other end you see the phenomena of interest imbedded in a distracting context where it is difficult to tell figure from ground. That is how it is when one considers a study in the context of its development; the choices are numerous and their combinations escalate exponentially. Figure 3 shows, in the next links of the chain, a sampling of the alternatives that face the researcher in translating this simple hypothesis into a design. While only touching on the possibilities, it gives an idea of the decisions involved in design choice. The chosen design in the figure suggests a set of reasonable alternatives. These might be combined into a study that would lead to a final link, the conclusion.

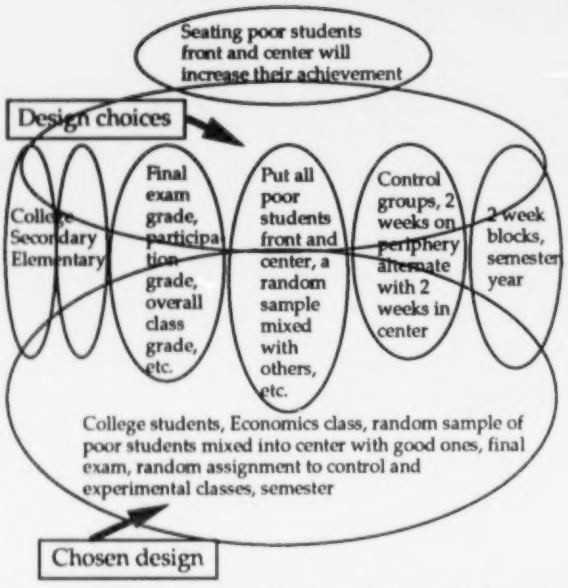
Seating poor students front and center will increase their achievement
Design choices
College
Secondary
Elementary
Final exam grade, participation grade, overall class grade, etc.
Put all poor students front and center, a random sample mixed with others, etc.
Control groups, 2 weeks on periphery alternate with 2 weeks in center
2 week blocks, semester year
College students, Economics class, random sample of poor students mixed into center with good ones, final exam, random assignment to control and experimental classes, semester
Chosen design

Figure 3: Design choices and the chosen design in the classroom seating placement study

It, in turn, might then be the basis for another study as indicated in our prototypical chain of reasoning. Let us examine each of the links in more detail.

Explanation, Rationale, Theory, or Point of View

How does the typical article begin? The first paragraphs usually describe the rationale underlying the relationship the researcher intends to demonstrate. They discuss previous research studies, showing their relationship to this study and indicating how this study "stands on their shoulders." Thus, this study might begin with a statement about how most teachers have probably noticed that discussions seem more generally to involve students seated in the front and center of the classroom than those in the periphery. This suggests a pattern that might be used as a treatment to help underachieving students. One would cite Hare and Bates (1963) to the effect there are action zones in the classroom and that those students who sit in the front and center seem to interact more often with one another and with the instructor. One could then reinforce this with Wulff (1977) and Becker et al. (1973) by noting that most achieving students prefer to be seated in front and center. Does this contribute to their achieving? That is the question to be answered by this study which hypothesizes that it does.

The *explanation, rationale, theory or point of view* underlying a hypothesized relationship is very important since it is the basis for understanding and interpreting the rest of the presentation. An *explanation* indicates how the relationship works. A *rationale* indicates the basis for thinking that it works this way. A *theory* indicates

how this relationship fits into a larger scheme of things, how these variables relate to others. A *point of view* indicates how this researcher views this relationship in relation to how others have. In building this section of the study, one draws upon previous relevant work, selectively citing it to indicate that this idea is not a "bolt from the blue," but is solidly based on what has gone before. In Figure 1, this is represented by the combination of the small links at the top of the figure labeled "Links to previous research studies." The large link to which they are fastened represents the explanation, rationale, theory, or point of view which is based on them. Figure 2 translates Figure 1 into the particular studies cited and the rationale derived from them for the study.

Questions, Hypotheses, Models

Joined to the "explanation, rationale, etc.," in Figure 1 is the "questions, hypotheses, models" link. In our experimental study, the *hypothesis* is: "Seating poor students front and center will increase their achievement." It is a hypothesis since we know enough to go beyond merely stating a *question* that tells us where to look. We know what we shall look for, improved achievement. We don't know how much achievement, nor exactly how it is linked to a certain amount of the treatment, so we can't make a precise *prediction*. That is the next level up when we know even more about the phenomena. When we can link all, or a great many, of the variables in the situation (the length of treatment, how students would be arranged in the center, how the teacher would react to them, etc.) and can then make a more precise prediction, then we have a *model*. In this case, there is enough previous research to suggest there may be a relationship, but not enough to make a precise prediction or build a model. We have more than enough for a question which tells us where to look but not what to expect. So we have a hypothesis.

At this level in the chain of reasoning, we have a question, hypotheses, or model, depending on how much previous research gives us a basis for knowing what will happen.[2]

Research Design

After stating the expected relationship, the article would begin describing how the study was carried out. Carrying out the study means translating the various facets of the presumed relationship into aspects that, so to speak, dramatize it. A playwright, having described a plot as "Susie falls in love with John," must then write a script that translates that into a scene where individuals move to certain places at certain times, say certain things that convey "love," etc. Just so, the researcher must translate in this study such terms as "poor student," "good students," experimental class." But, that is not all that has to be translated.

We think of there being six aspects to look for when we examine the translation of the hypothesis link into a study. Together they constitute the design of the study, and are represented in the six rings interlinked with design. These rings correspond to the "five W's and an H" that all journalists learn to include in a story: who, when, where, what, why, and how.[3] For research we want to know: (1) Who was involved in the study (subjects), (2) Where (situation), (3) Why did an effect occur (what was the cause—the *treatment*), (4) What effect occurred (observations or measures), (5) How do we know an effect occurred (basis for sensing attributes or changes tells us), and, finally, (6) When, that is, in what sequence did the various parts of the study take place (procedure—who got what treatment and what measures or observations and when and how these were given).

Let us examine the choices made in these six facets of the study as indicated in the ring labeled chosen design. To truly operationalize the choices we will have to be much more specific than even the choices indicated in Figure 3. For example, we might specify that the subjects are sophomore college students in economics classes at Zerbino University enrolled in the introductory course in economics, Econ 201, a large multisection course. "Poor students" are those who achieved a grade point average of 1.75 or lower their first year. This translates the subjects and situation links into choices.

The cause or treatment (the "why" of the study) is a mixture of four poor and four "good" students (operationally defined as students with a first-year GPA of 3.0 or better) randomly selected from those enrolled in Econ 201. The first day of the experimental class the instructor begins by assigning these eight individuals to seats front and center, acting as though he were going to assign everyone to seats. Then exclaiming "This is taking too much time!" tells everybody to take seats quickly and then sign the seating chart on the clipboard as it is passed around the room. In the control class, students are allowed to take seats as they enter. They similarly sign the seating chart on the clipboard. Both control and experimental sections have the same instructor who indicates the assigned seats are so that he can learn their names more quickly and get to know the class. He asks them to keep the same seats for the semester. This translates part of the procedure: indicating who gets what treatment and how. Note again how much specificity must be added to operationalize the treatment.

The observation or measure by which the effect is sensed is the common final examination given at semester's end and jointly prepared by all the section instructors. This translates the rest of the procedure.

The "how" by which the effect was sensed—the "basis for sensing attributes or changes"—is the comparison of the achievement of students in the experimental and control class sections on the course final examination. Random selection of the students and random assignment to treatment and control groups helps rule out certain alternative explanations of the effect.

All the important information regarding the design and structure of the study is usually presented in the mid-section of the write-up, typically under a heading of "procedure." The concepts used in the explanation that were pulled together into a hypothesis, have been translated into actions. These are the basis for gathering the data for analysis.

Data Analysis and Conclusion

The data of the study would be presented next showing whether the hypothesized relationship is demonstrated overall, whether there are differences among the sections, and, if there are, what characteristics might account for them. The latter helps us build a fuller understanding of how the treatment acts, and what variables moderate it through potentiating it or weakening it. This, in turn, is summarized in the conclusion, the last link in the chain of reasoning for this study.

The Next Study

The last three links shown in Figure 1 actually belong to the next study which builds upon this. In that study, the top one of those links is one of those "links to previous studies," rings shown at the top of the figure representing this study. It would use the data from this one to undergird some further explanation of this or a related phenomenon.

In summary, the chain of reasoning begins with links to the results of previous studies that are used to build forward to an explanation, rationale, or point of view. Depending on how much previous knowledge is found, one draws from it a question, hypothesis, prediction or model. This, in turn, is translated into a design which consists of choices of subjects, situations, treatment (or independent variable), observation or measures, basis for sensing attributes or changes, and procedure. The design guides one in the collection of data which permits one, by data analysis, to demonstrate a relationship. The demonstration of the relationship and conclusion, in turn, may be picked up by a new study.

Four Useful Characteristics of the Chain Analogy

If, as most chains are, the chain of reasoning were made of metal, it would have certain physical properties. These, by analogy, are useful in understanding the use of the chain of reasoning in research. Three propositions, one of which is a corollary of the first, flow from this analogy (Krathwohl, 1985). Let us examine them.

A Chain is Only as Strong as its Weakest Link

Just as a metal chain breaks at the weakest link, so does an argument for a knowledge claim. As much as any part of the argument for a knowledge claim can be faulted, the whole chain is weakened and one is less likely to accept the claim. If the fault is serious enough, the chain fails and the claim is rejected. For example, suppose one believes that, rather than because it increases their achievement, good students choose to sit front and center because it gives them greater visibility to display their abilities—it is an "ego trip." For such persons, the stated rationale might be unconvincing. Suppose this belief is further combined with the fact that the study was done on only either a single pair of sections or only a few sections. If one has any realization of the great variability among class sections due simply to random factors, one might prefer to accept the alternative explanation that the apparent confirmation of the hypothesis is merely a chance occurrence. The chain of reasoning fails to be convincing.

All Links in the Chain Should Be Equally Strong

A second characteristic of a metal chain, and a corollary of the first, is that all links in the chain should be built to about the same strength. This is, of course, typical of a metal chain; one does not find a set of strong links interrupted by a small thin link. Yet, that sometimes happens in a study's chain of reasoning without one realizing it occurred or its seriousness. It makes little sense to have one link in the chain thick enough to anchor a building in a hurricane and others as thin as a decorative gold chain. Thus, there would have been little point in allocating considerable resources to the observation and measure link (maybe constructing a special final examination that would emphasize economic reasoning in contrast to memory of facts) if one had not done something to assure that the instruction was designed to give practice in improved economic reasoning.

In whose judgment should the links be of equal strength? One's audience makes the final judgment; one is building a chain intended to achieve a consensus about the interpretation of the findings. One must satisfy one's own personal standards first, but the interpretation of the data being advanced will be accepted by others only if their standards are met as well. Anticipating what their thresholds are is a problem, but it is one that cannot be avoided. Knowing these standards is part of the socialization process which maintains science as a social process.

The real problem occurs when one's personal priorities about what to strengthen differ from those of other persons, and the resources are not sufficient to satisfy both. Resources are always limited, usually too much so. This is a situation where trade-offs are required and in which entirely satisfying all parties is not possible. One tries, as best one can, to find the choice that optimizes satisfaction for all.

This is one of many trade-offs hidden in the research process. Because researchers differ about trade-off solutions, one is faced with more than one "right" way to do a study, an unanticipated characteristic of science. It is a characteristic that makes many people uncomfortable; indeed, some will argue there is only one best way to do a study—a position you will find is difficult to support. But, such arguments are also part of the social process of research. They get resolved as there are efforts to replicate or build on studies. As such efforts are successful a consensus builds around the trustworthiness of the generalization and it is accepted as knowledge.

Each Link in the Chain is Determined by the Prior One

The third characteristic is a statement of the way the information must be presented to logically link it together. Each link is dependent on the preceding one. The explanation or rationale is built upon previous research. The question, hypothesis, or model grows out of that rationale or explanation. As earlier indicated, the extent of knowledge about the problem determines whether a question, hypothesis, or model is formulated. So the second link is dependent upon the first.

The next link, the design of the study, is a translation of the prior link into the operations which constitute the study. What can be shown in the next link, demonstration of the relationship, is dependent on the design choices. This, in turn, leads to the conclusion, which is clearly dependent on how the data turned out.

By the way each step advances the argument for the knowledge claim, it sets boundaries for the next; each step is shaped by the argument to that point. Thus, being aware of the desired breadth for the lower links, we need to build in sufficient breadth in the upper ones. If one wished to generalize beyond economics, one might include a variety of different subject matters and instructors in the experiment.

Where Links Share the Load, One of Them May be Strengthened to Compensate for Weakness in Another

The last characteristic of the chain is not quite as obvious. Though it rarely occurs with metal chains, it is important. Where several horizontal links across the chain's breadth connect the links above and below them, each of the horizontal links shares the load. Therefore, a weak link may be tolerated if another of the horizontal links is made stronger. In the research chain of reasoning, this situation occurs at the design level where all six facets of design together link the design as a whole to the demonstration of the relationship. For example, in the study being considered, if one believed that the treatment might be effective, but only weakly so, then one might compensate by increasing the number of classes in the study.

The Chain Applies to Reports of Research; It May or May Not Apply to the Research Process

It probably is clear to everyone, especially qualitative researchers, that while the chain of reasoning may well describe how research is reported, it is not a description of how a typical research study is carried out. Certainly a typical qualitative study is not done deductively, but probably most experiments don't start at the top and proceed through the links either. Sometimes one has an interesting sample of students, or a new measure and wonders what one can do with it—one starts in the middle of the chain to develop the study. Or one finds leads in the literature that makes one think one has a problem, starts to translate it, and finds one must go back and answer some new questions—operationalizing variables makes one think concretely and often results in many iterations of a study's design. Sometimes a researcher picks a single finding out of a mass of data and constructs a report around it, making it appear as though this were the whole study rather than just one small part of a larger one. So although there are occasions when a study is designed from the top down, as often as not, the chain of reasoning is a model for the research report rather than the process.

Summary

- All studies setting forth a generalization as true are expected to supply certain information which allows readers to evaluate the study and make a judgment whether to accept the interpretations of the evidence being advanced.
- Most, though not all, studies follow a standard sequence in presenting the findings of their research. If they do not follow the sequence, they nevertheless include the same data.
- The case for a generalization is presented (or could be arranged) in a sequence which is a chain of reasoning.
- A universal or prototypical model of such a chain of reasoning may be constructed which contains the essential elements of the chain.

- Such a model begins with an explanation, rationale, theory, or point of view which is linked to—that is, grows out of—previous research studies and writing.
- The generalization which is being advanced flows from this explanation, rationale, theory, or point of view.
- The stronger the previous evidence, the more detailed in its development, the more comprehensive in its breadth, the stronger the explanation, rationale, theory, or point of view, the stronger the next link that flows from it.
- With the strongest prior knowledge, one can pose a model that links many variables. With less prior knowledge one may still be able to make a reasonably precise prediction of how big an effect will occur, as well as where and how it will happen. With still less, one may have a hypothesis that describes what direction things may take and how they are related. And with the least prior knowledge, a question focuses one's attention on certain aspects of the phenomena of particular interest which presumably have potential for guiding further research.
- The question, hypothesis, or model is translated into the design of the study. This results in making choices of who (subjects), where (situation), why (treatment), what (observations or measures), how (basis for sensing attributes or changes), and when (procedure).
- These choices determine how one gathers data which demonstrate whatever relationship is being studied.
- A conclusion is drawn to represent the most appropriate interpretation of the data.
- The chain of reasoning model is analogous to a metal chain and has some of the same properties:
  - — It is only as strong as its weakest link.
  - — All links should be of the same strength except where they share the load.
  - — The nature of each prior link in the chain constrains the nature of successive links.
  - — Where links share the load, as they do between "design" and "analysis" one or more of those links may be made stronger to compensate for the weakness in one or more of the others.

Footnotes

[1] This article was adapted from Chapter 5 of the author's textbook, *The Methods of Social Science and Educational Research: An Integrated Approach*, which is scheduled for publication by Longman in 1992. Copyright 1991©, D. R. Krathwohl.

[2] The chapter from which this material is taken bases the discussion on an article reproduced in the text. That article interposes a paragraph at this point in the chain which summarizes the rest of the article. The point is then made, referring to that article, that the chain of reasoning is a format to be followed in presenting one's case, but not "...slavishly or rigidly. Each author adapts the format to the requirements of the readers. In this case, this article appeared in a journal...predominantly devoted to [natural science]...reports. Non-social scientists might be interested enough to read a few paragraphs, but not...the whole article. Placing the summary early, right after the rationale and hypothesis is clever writing..." (Krathwohl, In press). Because this summary of the chapter is based on a different study, the point is made in this footnote instead of the presentation above.

[3] This journalist's ditty, borrowed from Rudyard Kipling, may be useful mnemonic for the six facets of design:

> I keep six honest serving men
> They taught me all I knew:
> Their names are What and Why and When
> And How and Where and Who.

For research application, this translates into:

Who	Subjects (Who are they?)
Where	Situation (Where did it take place?)
Why (the cause)	Treatment (This is why something would be expected to occur)
What (the effect)	Observations or measures (These tell what occurred)
How	Basis for sensing characteristics and changes (This tells us how we know an effect occurred)
When	Procedure (When did what subjects receive what treatment, which observations or measures did they receive, and where did they receive the treatment, measures and/or observations?)

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Affective Objectives: A Discussion of Some Controversies

Cheryl Ackerson *

Introduction

The literature on the affective domain (I reviewed over 200 abstracts) seems to be pursuing two different although connected ideas: (a) affective education, as a type of education, and (2) education that includes affective objectives in specific content areas, which I will refer to simply as affective objectives. In this paper I first attempt to draw a distinction between the two. Next, I focus on the controversies over objectives in the affective domain and discuss the difficulties and successful strategies for identifying and evaluating these objectives. Finally, I pose research questions in the area of evaluation of affective objectives.

Affective Education

Affective education is described by various authors as:

- focusing on students as persons—their mental health and personal development, social skills, roles in society (Sonnier, 1990);
- assisting students in developing "joy in learning" (Sonnier, 1990);
- the characteristics of values, academic self-esteem, anxiety, interests, locus of control, attitudes and preferences (Anderson, 1982).

Affective education is concerned with the student's experience of learning. In Sonnier's (1990) *Affective Education: Methods and Techniques*, several discussions revolve around the importance of acknowledging individual differences in students' learning styles (and teachers' teaching styles) because these differences can significantly influence an individual student's experience of a particular learning activity. Emphasized are individual differences due to hemispheric dominance, a simplistic explanation of the theory being that students with left-brain dominance are more analytically and verbally oriented and those with right-brain dominance are more visually oriented and creative. She argues that traditional educational approaches typically have favored the more analytic learners, leaving visual learners labeled as daydreamers, inattentive, and slow. Sonnier encourages a "neuroeducational" approach, which she defines as "holistic education" (teaching of both cerebral hemispheres simultaneously and concurrently) with metacognitive development (the students' awareness of knowledge acquisition)" or as "hemisphericity-based instructional management with accountability." This issue of accountability is discussed in rather strong terms by Sonnier who states that ignoring individual differences has resulted in many students experiencing "psychological brutalization, hurt, and frustration."

In addition to the "humanistic" concerns for individual students (the person being taught is as important as what's being taught), why else is affective education important? Sonnier (1990) mentions several considerations about this issue:

- the impersonality of society is propagated by schools, which focus solely on cognitive skills;
- attending to affective issues can increase attainment of cognitive skills (a theory that is, by the way, supported by motivational principles in behavioral sciences [Fleming and Levie, 1978]);
- the broad aims of education have always been concerned with values and attitudes, and it's time these general aims were brought into the classroom at the level of specific objectives;
- lack of attention to this domain could explain students' perceptions that what happens in the classroom is irrelevant to their lives;
- cognitive teaching and learning promotes emotional distance from content areas, a serious problem for many subjects (e.g., cultural sensitivity);
- affective education may be able to help analytic learners become more visual and visual learners become more analytic.

Clearly, according to Sonnier affective education is, or ought to be, a broad, critical concern of education today. Sonnier is not alone in her use and promotion of this concept. The other contributing author to her edited book shares her conviction and her understanding of the term affective education. They are part of a growing movement among educators to favor approaches to teaching that engage the learner emotionally, that "exercise both hemispheres" (described by Howard Gardner, 1983), that use visualization techniques such as "guided imagery" to enhance learners' belief in their ability to learn and may even use techniques that verge on hypnotism, based on the "suggestopaedia" approaches pioneered by Lozanov (1978). These approaches to teaching have gained a number of generic labels, for example "accelerated

learning," (as in the U.S.-based SALT, or Society for Accelerated Learning Technology), or "integrative learning" (as in the U.S.-based National Academy of Integrative Learning), or indeed "affective learning" (as in the U.K.-based SEAL, Society for Effective Affective Learning).

Affective Objectives

According to Krathwohl et. al. (1964), affective objectives "emphasize a feeling, an emotion, or a degree of acceptance or rejection. They vary from simple attention to selected phenomena, to complex but internally consistent qualities of character and conscience. [They are often] expressed [in educational objectives] as interests, attitudes, appreciations, values, and emotional sets or biases." Examples include:

- a willingness to take part in musical activities;
- to perform simple experiments relating to biological or physical sciences to satisfy his curiosity about scientific questions;
- to assume responsibility for drawing reticent members of a group into conversation;
- to reject stereotypes of people of various races, cultures, national origins, and occupations;
- to change opinion on controversial issues when an examination of the evidence and the arguments calls for revision of opinions previously held.

Krathwohl's well-known model or "taxonomy" of the affective domain suggests five hierarchically organized categories of affective objectives (which correspond to the five examples listed above):

- Receiving: sensitivity to and a willingness to take in or attend to certain phenomena;
- Responding: willingness to participate actively in a given category of task or activity;
- Valuing: consistently attaches worth to a phenomenon;
- Organization: bringing together different values and beginning to build an internally consistent value system;
- Characterization by a value or value complex: synthesis and internalization of a value system.

This taxonomy has been a useful guide to teachers developing instruction aimed at the affective domain, but has also fed a concern over the distinction being drawn between the cognitive domain and the affective domain. It may be seen to suggest a division of these areas which, in reality, does not exist. For example, the highest level of the cognitive domain involves evaluation—judgments about value and worth—essentially, an affective skill, and the affective level of conceptualization certainly implies a cognitive skill. The two domains are actually closely intertwined but teachers and instructional designers often forget this so much so that Martin and Briggs (1986) felt it necessary to suggest a model for the planning of integrated instruction in the affective and cognitive domains. Acknowledging this inter-connectedness between the two domains is important in understanding the need for as much of an emphasis on carefully developed and evaluated affective objectives as there is on cognitive domain objectives in education.

The Distinction Between Affective Education and Affective Objectives: Fact or Fantasy?

In the previous sections I have briefly described how certain authors define affective education and affective objectives. The distinction they seem to imply here is that while affective education concerns itself with broad issues concerning the students' experiences of the educational process, affective objectives are focused on the development of a particular content-related affect. However, Sonnier (1990) also states by way of example that affective education might be concerned with attitudes to the learning of science (enjoyment, satisfaction in science courses), whereas an affective objective might be the development of a certain scientific attitude ("tolerance of the views of others," "suspended judgment"). This would seem to add confusion rather than clarity to the distinction, given that both of these examples fit very comfortably into one or other of the categories of Krathwohl's (1964) taxonomy of affective objectives.

It might help to clarify this confusion by focusing on a general distinction that may be observed in the writing of both "camps" (if that is an apt term). Objectives, by definition, are the desired *outcomes* of a teaching-learning process, and affective objectives are no different in this respect. However, most of the writings that emanate from the affective education "camp" stress aspects of the teaching-learning *process* itself. Looking at the two bodies of literature from this "systems" viewpoint, we may conceptualize one "camp" as emphasizing PROCESS, whilst the other is emphasizing PRODUCT. Of course, both emphases are equally important in practice (as are CONTEXT and INPUT which refer to the societal, cultural, and prior learning factors in learning).

Although a distinction is being emphasized by the affective education camp, the notion of affective education usually includes the accomplishment of affective objectives. Whether these objectives are related to specific subject matters or related to overall broad aims

and goals of the educational system is where the distinction lies, according to Sonnier. My own interpretation of the distinction is somewhat different. As mentioned before, the unique aspects of what most writers describe as affective education are concerned with the process of teaching and learning. However, the prime objectives of an affective educator may on occasion be principally cognitive. For example, the most spectacular claims of the suggestopaedia movement relate to dramatic reduction in the time required to master a foreign language (cognitive objectives) when affective learning processes (such as relaxation, mood music, visualization, and suggestion) are used to overcome learning inhibitions and promote belief in one's ability to succeed. If these latter outcomes are what Sonnier means by the "objectives of affective education," then all well and good. However, let us be clear that striving for such "process" objectives in no way reduces the need to define and achieve specific "outcome" objectives, both cognitive and affective.

Controversy about Affective Objectives

One reason for controversy about affective objectives is the important distinction in this country made between education and indoctrination. According to Krathwohl et. al. (1964), "...education helps the individual to explore many aspects of the world and even his own feelings and emotions, but choice and decision are matters for the individual. Indoctrination, on the other hand, is viewed as reducing the possibilities of free choice and decision." Because of this concern with indoctrination or propaganda, education has become focused almost solely on cognitive areas.

Another reason for controversy stems from a largely held cultural belief that our values, beliefs, morals, and attitudes are private business and that one does not have to share these publicly unless one chooses to. Affective objectives are seen as possibly infringing on this right to privacy (Krathwohl et. al., 1964).

Another issue is a sometimes commonly held belief that if cognitive learning is achieved, affective learning will be a natural by-product. This is not necessarily true. Students could, for example, gain much in the way of knowledge about literature, but might gain an aversion to reading great literary works.

It is indeed more probably true that achievement of cognitive objectives requires as a prerequisite an adequate level of positive affect towards the content of the learning exercise. This is a position not only defensible from cognitive or humanist psychology standpoints, but even from the principles of operant conditioning, that states that to be reinforcing a reinforcer must be desired by the organism (for success in learning to be reinforcing, the learner must approach the learning task with a desire to succeed) (Gilbert, 1962).

Perhaps the most common cause for controversy one encounters when discussing affective objectives is the concern over evaluating these objectives. It is often believed that these objectives refer to inner states of mind and emotions and therefore it is impossible to objectively and concretely measure whether or not an affective objective has been obtained. There is great concern over the possibilities of subjective scoring/grading in these areas and that favoritism could result in one student gaining a higher score than another because the criteria are so vague. The topic of evaluating affective objectives deserves further discussion.

Evaluating Affective Objectives

The question and answer posed by Fogleman (1982) is a good place to begin this discussion. "How do you measure something inside a person's mind? Get them to translate an internal attitude into an external behavior." This seems to be the crux of the problem of evaluating affective objectives. First, the objective must be written in such a way that it *can* be measured. Smith and Reyes (1982) suggest that one reason we have difficulty in writing clear affective objectives is that we're used to seeing a specific behavior and then drawing a generalization from that behavior. To write an affective objective, one is usually attempting to do just the opposite, go from a generalization (a desired affective outcome) to a specific behavior. They suggest one ask the following questions:

1. What kinds of things do people do who have this desired general characteristic that others (who don't have it) do not do?
2. (a) Are people who have (the desired characteristic) more likely to do (the behavior that's been identified in #1). (b) Are people who do not have (the desired characteristic) also more likely to do (the behavior that's been identified)?

The answer to (a) should be yes and the answer to (b) should be no if the objective has been written clearly enough.

Stuart and Wallace (1988) suggest that Mager's (1968) five step process for goal analysis can be helpful in writing clear affective objectives:

1. Write down the goals.
2. List the performances that, if observed, would indicate the goal is achieved.
3. Sort the list—delete duplications and unwanted items. Repeat steps 1 and 2 for any remaining abstractions (fuzzies) considered important.

4. Write a complete statement for each performance, describing the nature, quality or amount you will consider acceptable.
5. Test the statement with this question, "If someone achieved or demonstrated these would you say he has achieved the goal?"

Once an affective objective has been written clearly enough to identify the observable behaviors that would indicate the achievement of the affect, then an evaluative or measurement process must be identified. There are many reasons for evaluating affective (and other types of) objectives. Fogleman (1982) identified the following:

- determine the progress that a student is making toward achieving the goals of the program
- help the individual student maintain strengths and eliminate weaknesses - motivate the student.

This brings us to the issue that is the source of most of the concern about affective objectives and the reasons teachers tend to avoid including them in their lesson plans. How do you evaluate the achievement of affective objectives? The literature (Ohio State University, 1984; Moore and Harbeson,1986) revealed the following as possibilities:

- attitude scales: both rating scales and semantic difference scales,
- structured and unstructured interviews,
- oral tests,
- essay test items,
- problem-solving test items,
- anecdotal records,
- behavioral checklists,
- student journals,
- interviews,
- tally charts,
- rating scales,
- sentence completion sheets,
- questionnaires,
- profile sheets,
- records of behavior management systems,
- sociograms,
- feedback from students, teachers, parents and/or peers.

Thorndike and Hagen (1969) identify the advantages of observational assessments as being a record of actual behavior and its application to a natural setting and the disadvantages as costs of observer time, effect of fitting an observer into the setting, eliminating subjectivity and bias, determining meaningful and productive sets of behavior categories to observe, determining significance of an isolated item of behavior, the external character of observation, and observing a behavior out of context. Fogleman (1982) suggests that the major disadvantages seem to be subjectivity and bias and that these can be diminished with proper construction of the evaluative tool.

Krathwohl et. al. (1964) discusses in some detail ways to evaluate and test the achievement of objectives. It is stated that as one reaches the fourth level of affective objectives (organization of a value system), the measurement of their achievement necessarily becomes more complex. And, in the fifth level (characterization by a value or value complex), measurement is even more difficult. In fact, Krathwohl suggests that education rarely attempts to achieve this level of the affective domain. However, detailed discussion of ways to measure and evaluate affective objectives on all the levels is offered. Many of the suggestions include strategies such as those included on the list above. There are many attitude scales, rating instruments in various subject matters and behavioral checklists available.

Given these available aids and possibilities for evaluating affective objectives, why does this area of learning continue to be avoided by many curriculum developers and classroom teachers? Perhaps the reasons are those cultural beliefs and attitudes about privacy and "propaganda" noted above and not so much the difficulty in evaluating them that is so often mentioned. Many studies certainly reveal that most teachers are attempting to achieve affective outcomes in their students, even though these outcomes may not have been stated in the formal objectives. The problem, however, with this situation is that there is no way to then measure whether or not the desired outcome has actually been achieved, and therefore no feedback to the teacher as to whether or not her strategies/methods/techniques have been effective (or perhaps even damaging!). Given this still vague or loose sense about the place of affective objectives in education, what are the research issues yet to be explored?

Research Issues to be Explored

In the over 200 abstracts reviewed, there were only two studies identified that specifically tested the utility of Krathwohl's taxonomy on developing and evaluating affective objectives. One study (Valois, 1985) evaluated the relationships between cognitive and affective taxonomic outcomes of a college course in personal health education. The study devised valid assessment instruments to measure cognitive and affective outcomes and evaluated the relationship between hierarchical patterns of the cognitive and affective domains developed by Bloom/Krathwohl/Masia (1956 and 1964). The assessment questionnaire contained two items related to objectives for each sub-level of each level of the hierarchy in both domains. Conclusions were drawn

that a relationship does exist between the taxonomies.

One area of research that seems important would be on the techniques for evaluating the achievement of affective objectives, testing Krathwohl's ideas to determine their feasibility and practical use. Another area would be to research the current status of affective objectives at the level of the classroom lesson planning. Is it still true that there is an avoidance of these objectives? If so, it would be interesting to see if the "erosion of affective objectives" identified by Krathwohl et. al. (1964) is still occurring, that is, that affective goals are included in broad curricular descriptions, but seem to be dropped as the instructional planning reaches levels closer and closer to the classroom.

Conclusion

An attempt has been made to clarify the distinction between what has been labeled affective education and affective objectives. The new term seems to be born out of a growing concern for the engagement of the emotions in the learning *process*, and in no way supplants, or argues against, the need for the more venerable construct of affective objectives as desired *outcomes* of learning. The controversy over affective objectives has been explored with an emphasis on the issue of evaluating affective objectives. The available means for evaluation of affective objectives seem to be greater than previously believed and so the reason for avoidance of formally written affective objectives still is unclear. The areas for potential future research seem numerous.

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The Writings of David Krathwohl: A Scholar's Eye-view of his Contribution to the Literature

Charles R. Dills *

David Krathwohl has been a prolific writer throughout his career, spanning the period from the early 1940s till the present. The first book I ever read when I entered graduate school (more years ago than I would like to remember) included a chapter by Dave (The Psychological Basis of Integration, in the 57th Yearbook of the National Society for the Study of Education). And, as with a great many of Dave's writings, this one was more than technically good or useful, but was both interesting and compelling. That chapter still influences my thinking even today. I am sensitized to the fact that all instructional materials and activities are integrated, through their effects, with all other such materials and activities, as well as all non-instructional events, in the lives and psychologies of the students, whether we plan it that way or not. Therefore, Dave has reminded me, through his article, that we had better plan it this way if we want to achieve what we say we do. I have found this to be particularly important when designing integrated military training systems, such as the current Canadian Patrol Frigate project I am working on, and I regret that not only Dave's chapter, but his idea behind the chapter, are not emphasized often enough in instructional development courses or projects.

Even though I have only recently come under the direct influence of Dr. Krathwohl, by moving to Syracuse University, he has touched me in significant ways throughout my career. Many themes can be found intertwined throughout Dave's writings, and several of these have had broad impact upon both the field of educational technology and also the more general area of educational research practices.

Further, Dave has written not only for the technical specialist, but also for teachers and students of the teaching process. For example, I next ran into Dave's work when I learned about the *Taxonomy of Educational Objectives* (1956) a work still considered to be a basic tool and a classic book in the field. It was co-authored by Dave, Benjamin Bloom and others (Bloom et al., 1956). This work established a uniform "language" with which to think and talk about educational objectives in the cognitive domain. Designed as a tool to assist in the planning of educational goals, specific objectives, and appropriate test instruments, it has served as such to generations of educators and instructional designers for over 35 years, and despite many efforts to design alternative tools, still stands as the most-used taxonomy.

The first handbook on the cognitive domain was followed by a second on the affective domain (Krathwohl et. al., 1963). This has enjoyed similar acceptance in its nearly thirty years of continous availability and has been enormously influential on both curriculum and test design. It is perhaps unfortunate that this pioneering work was never concluded by extending the taxonomies into the psychomotor domain and beyond. Several attempts have been made by other authors to develop a similarly useful design tool for psychomotor objectives selection and testing, but none of these have stood the test of time as well as Bloom's and Krathwohl's handbooks for the cognitive and affective domains.

Dave's versatility is shown by another area in which he has had a long-persisting interest, the nature of the research process. He has written widely in this area for specialists, beginning with the editing of an issue of the Review of Educational Research in 1957, and continuing through recent papers, such as those on the nature of validity, to his current book (*The Methods of Social Science and Educational Research: An Integrated Approach*), which is reviewed elsewhere in this journal issue.

Not all of Dave's work has been in research. He has devoted a great deal of effort towards helping students and those practicing in non-research oriented professions to better understand and conduct research. One of his most recent books, *How to Prepare a Research Proposal* (1988), (also reviewed in this issue) has quickly become a required tool for graduate students. But Dave has also written many other works to help students, such as his many articles in works as the *Social Science Encyclopedia* (1985), the *Concise Encyclopedia of Psychology* (1987), the *Encyclopedia of Education* (1971) and the *Wiley Encyclopedia of Psychology* (1984). He has also written special articles on research methodology for such people as architects (1964) and librarians (1963).

Not all of Dave's work has been devoted to generalized research methodology. He has also made many specific contributions to subject-matter areas, such as the teaching of handwriting (1963), counseling therapy using video tape (1972, 1963), stimulated recall (1965), curriculum and materials development (1965), programmed instruction (1967), teacher evaluation (1968), performance-based instruction (1971) and value-free evaluation (1981, 1980).

Dave Krathwohl is verging upon retirement, but his best work is still to come. Dave has been writing a book

which unites many of the strands of his interests over the years in a single, integrated treatment. The book, Methods of Social Science and Educational Research: An Integrated Approach (1992) is designed to teach the student about statistics, research design, data interpretation and hypothesis formulation. But more, it is designed to introduce the student to science, and bring him or her into science, as a human activity.

This book is intended to serve as a textbook for graduate students, and will undoubtedly become a best seller among such books. More interestingly, this book is going to be read by many who have been practicing research for years. Gaps exist in the education of most researchers, especially with regard to the sociological and anthropological nature of science, the creative side of research, and the intuitive shaping of their sense of the research process. This book will go a long way towards not only producing better-prepared graduates, but also towards generally improving the level of self-understanding among the researchers already out in the field.

It is hard to imagine Dave ever having an achievement that surpasses this book, but he probably will. His contributions to the field are not likely to stop merely because of some administrative arrangement such as retirement. I suppose my professional life will continue to be influenced by his future work, just as it has been in the past, and still is being at the present time (I just became aware of his work on stimulated recall as I write these lines, a topic I currently need information about; his influence never seems to stop). But most people who read this will not find this conclusion unusual, since they have also probably had this experience with his writings.

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SYRACUSE UNIVERSITY: ARABIAN PENINSULA EXCHANGE PROJECT

The Office of Citizen Exchanges (E/P) of the United States Information Agency selected the Training Systems Institute at Syracuse University to sponsor the development of a two-way exchange program on learning and physical disabilities. This program began with a three-week U.S. seminar/study tour for 10 senior level representatives from government, universities, and philanthropic organizations from the Arabian Peninsula to the U.S.

Goals for the program are:

- observe and discuss ways counterpart organizations in the U.S. educate, train, and provide treatment for individuals with learning and physical disabilities;
- look at training opportunities for educators, administrators, and caretakers responsible for the implementation of programs for people with handicapped conditions;
- analyze the historical development and societal reaction to the implementation of the Americans with Disabilities Act (ADA);
- observe the ways various private and public organizations charged with implementing programs for people with disabilities interact to provide support and services to the clientele; and
- expose delegates to various types of Special Education programs available in the U.S. with an ultimate goal of providing possible models for use in Gulf institutions.

Representatives of the Governments of Bahrain, Kuwait, Qatar, Saudi Arabia, and United Arab Emirates arrived in the United States in early February. They spent one week in Washington, D.C. visiting professional associations and selected government agencies. An international teleconference was organized by WORLDNET to link the U.S. embassies in each participating Gulf country with the group in Washington. The second week was spent in rural Tennessee visiting local educational and community-based organizations and projects.

On February 24th, the group, along with two U.S. State Department interpreters, began their Syracuse area visit. The agenda for the Syracuse component of their schedule included visits to schools, projects, R&D centers, training and publishing organizations, and an SU Carrier Dome basketball event.

Phase II of the Project involves a visit to the respective countries by three members from Syracuse University. An extensive itinerary will expose the U.S. team to the problem that is being addressed, its extent, and its characteristics, as well as to the local resources and expertise for dealing with it. On the basis of this experience, specific sub-projects will be planned and implemented.

Methods of Social Science and Educational Research: An Integrated Approach

Charles R. Dills and Vincent Tinto *

David Krathwohl has just authored another book, *Methods of Social Science and Educational Research: An Integrated Approach* (1992), on the nature of research and its methodology. The author claims that his book begins from an intuitive base possessed by all of us. It then uses this base as a framework for the understanding and conducting of research. It does this through making the intuitive concepts more conscious, more precise and more organized into a conceptual structure. But this book accomplishes much more than this claim makes evident.

The book has been written primarily for students, not to impress the professor who teaches the course. At the same time, its contents have been chosen so as to help the professor teaching the course, and to fill in holes in the professor's background when necessary. The book makes prolific use of teaching aids, such as graphics, simple examples, stories, mathemagenic devices, and pictorials. Each chapter begins with an overview, a table of contents, a list of key terms, summary boxes, and application problems. There are two appendices, one a glossary and one a discussion of the various choices involved in the design of an experiment or other study. Conspicuously missing from the appendices, or the book in general, are the many sets of statistical and other tables usually found in the back of any book on research methodology. Also missing from the book is the academic style of writing that many students, as well as academics, have difficulty reading. Technical terminology is not missing, however, and the combination of appropriate language, both technical and literary, makes the book, for a statistics textbook, fun to read.

The real value of the book, however, as with almost any other piece of writing, lies in its conceptualization. First, the contents. The content of the book is chosen to give the student a broad understanding of method, with enough breadth to allow an instructor the choice of topics to include in a course, and enough depth to give the student more than just a passing acquaintance with each topic covered.

This has resulted in the inclusion of much material not normally included in research courses such as concept analysis, the nature of causality, and the nature of literature indices. Thus the student will have a broader understanding of the foundations of research than is typically possible.

Second is the way in which the book was designed to be used. It is largely a front-end loaded text, by which the author means that the book begins by presenting an over-view of the field, then follows with chapters designed to fill in the details. This results in a book that can be used in either a top-down teaching approach or in a detailed, building-block approach, at the instructor's discretion.

Third, research is represented as being a systematic problem-solving process, but the general problem-solving model is not taught. This is because several lines of research have indicated that the novice already follows this approach, and differs from the expert only in specific knowledge of the field. Thus the emphasis is on teaching this expert knowledge, and on problems designed to lead the student to use this knowledge in his problem-solving efforts.

Three other characteristics of the expert have influenced the design of the book. First, the student is led to think at a high level of conceptualization, using a subsumptive process called chunking. Chunking is the grouping together of many details in a single conceptual structure, so that many things can be considered at the same time. This is encouraged through the conceptual structure of the book, and through explicitly relating details to higher-level chunks.

The second characteristic derived from a study of expert thought is that experts do not think in terms of statistical formulas and abstract equations, but in terms of the concepts upon which these formulas and equations are based. This book has remarkably few formulas and equations for a textbook on research. Instead, the student is led to understand research in terms of concepts, with statistical tools deriving from these concepts as detailed implementations. Thus, understanding, not mechanical manipulations, are encouraged.

One aspect of the book with which the reader might not feel compatible is the explicit use of a particular model of the research process. Krathwohl adopts a social consensus model of research, and builds the book around it. Those who reject this model, or who accept an alternate model, might find this approach incompatible with their own teaching goals or styles. In any event, the book is so well organized that it could easily be used without advocating this model, if so desired.

A second aspect that some might find unusual is the

informal style in which the book is written. This style was chosen to make the text eas to read, more interesting, and clearer to the studer But it is an unusual style to find in college texts, a require some getting used to on the part of pot.ıtial adopters. Once adopters are acclimated to the style, however, they are likely to find that this style makes the teaching of difficult concepts easier. And students will probably find the style to be a welcome, beneficial change.

Finally, Krathwohl's book is designed to be not only a textbook, but later in the student's life to be used as a reference book and as a source for further independent study and review. In this regard, it stands out from the crowd of books on research methods in education that barely skim the surface of complex research problems. Readers of Krathwohl's book will find that it retains its usefulness, indeed becomes more useful, as they acquire more research experience.

Like all classics, Krathwohl's work will grow, rather than diminish, in value as time goes by.

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SIXTH ANNUAL EDWARD F. KELLY CONFERENCE HOSTED AT SYRACUSE UNIVERSITY

The Edward F. Kelly Evaluation Conference was established in 1987 as a tribute to the late Dr. Kelly, a Professor of Educational Evaluation at Syracuse University and later at SUNY Albany, who was very supportive of students and committed to their professionalization. The conference, dedicated to the ideals of Edward F. Kelly, is an annual student organized event which is supported and alternately hosted by the three sponsoring institutions, Cornell University, SUNY Albany, and Syracuse University. This year, the conference was held at the Goldstein Student Center of Syracuse University on April 3. It provided the continuing opportunity for graduate students from the three institutions to present and discuss their past evaluation findings and research results as well as current works-in-progress in education, the social sciences, and related disciplines.

This year's keynote session was delivered by a panel of recent graduates from the three institutions — Valerie Caracelli from Cornell University, Cynthia O'Brien from SUNY Albany, and Barbara Yonai from Syracuse University. The panelists addressed issues and challenges involved in the transition from the role of graduate student to professional researcher or practitioner.

The keynote address was followed by a format first introduced this year, the topical roundtables. The nine roundtable clusters were organized around a broad range of areas in evaluation to allow for additional informal discussion among students with similar interests. The themes included: cross-cultural evaluation; health programming evaluation; evaluating new technologies; evaluation dilemmas in practice; international evaluation; ethics and evaluation; internal evaluation; issues of authentic assessment; and engendering our own sociological imaginations as researchers.

The afternoon began with a spirited half hour poster session. The graphic displays consisted of an eclectic blend of charts, diagrams, elaborate models, photographs, and thought-provoking questions presented by nine students who stood by their work to answer questions and encourage participatory involvement. The remainder of the day was devoted to the delivery of 15 student papers and one panel presentation. As with the posters, the papers which were presented at this conference were recommended for inclusion in the program by selection committees at the respective universities. Three sessions were held concurrently, thus permitting participants to move between rooms, based on interest.

In addition to the 80 graduate student and alumni participants, faculty from Cornell University, SUNY Albany, and Syracuse University were available throughout the day to share ideas, information, and insights, both conceptual and practical, with their student colleagues in attendance. The Kelly Conference provides a unique avenue for professional networking and information dissemination. This conference, developed out of a concern for the professional development of students, will be hosted next year by Cornell University, as the vision and spirit of Edward Kelly live on.

Review of David R. Krathwohl, *How to Prepare a Research Proposal: Guidelines for Funding and Dissertations in the Social and Behavioral Sciences*, Third Edition, 1988, Syracuse University Press, Syracuse, New York

Deborah M. Fournier and Nick L. Smith *

David Krathwohl's *How to Prepare a Research Proposal* has had a long and increasingly successful history. The first edition was published in 1965 and was just 50 pages. The second edition followed in 1976 at 112 pages, and the third edition appeared in 1988 with 305 pages. The sales of the third edition have averaged well over 2000 copies a year since 1988, and the edition has been adopted for courses in over 200 institutions. The third edition is published by David Krathwohl, but it is marketed, advertised, and distributed by Syracuse University Press, who report being very pleased to have it on their list, for it is one of their strongest sellers (personal communication).

All reviews of both the second and third editions have been extremely positive. Major reviews of the third edition have been published in *Educational And Psychological Measurement* (Nolan, 1989), the journal of the Society of Research Administrators, *SRA Journal* (Sink, 1989), *The Grant Advisor* (Garrity, 1990) and *Educational Technology* (Borich, 1989). Additional reviews have appeared in the *Journal of Academic Librarianship* (1988), *Australian Journal of Psychology* (1989), and *R & D Management Digest* (1988). A few excerpts from these reviews will convey the high praise accorded this volume:

> "This book is a good reference for inclusion in a grants office library, one that encompasses more disciplines than its title indicates. It would be valuable as a textbook in a graduate-level course on research techniques." (Garrity, 1990, p. 19).

> "I found this book to be well and clearly written. The author is very good at carrying the reader from step to step and at explaining the different points which are necessary for a good proposal...The section on dissertation writing brings together in one place all the things a student hears piecemeal from faculty and other students. This book should be a welcome addition to any faculty or student's bookcase." (Nolan, 1989, p. 300).

> "With this latest revision, Krathwohl's treatise now ranks among the best available in the current "grantsmanship" literature. With the additional information for graduate/doctoral students, his monograph is more comprehensive than Lauffer's *Grantsmanship* (1983), Bauer's *The How to Grants Manual* (1984), or Meador's *Guidelines for Preparing Proposals* (1985.)" (Sink, 1989, p. 47).

We believe these reviews, though highly positive, misconstrue Krathwohl's volume as merely a "how-to" cookbook for generating a research proposal. Only Borich seems to recognize the broader conceptual context within which Krathwohl situates his recommendations:

> "...is a book that goes beyond the "nuts and bolts" of proposal writing to convey an understanding of and sensitivity to the decision-making context in which proposals are written...a research proposal is portrayed not simply as a tool for getting an idea funded but rather as a system of shared values constituting a decision-making context in which both proposer and reviewer choose to work." (Borich, 1989, p. 57).

This book is much more than a technical guide. Proposal preparation like any other type of communication involves both technical ability and the context in which it is employed. A researcher may know the language, but to be effective and appropriate she/he must know whom is being spoken to, when, where, and why—the social processes involved.

The strongest asset of this book is its combination of the technical knowledge of how to write proposals with an understanding of the decision-making contexts, logical chains of reasoning, and underlying social processes of the creation of knowledge. This is not just a book about how to write a proposal, but how to get funded within

the knowledge production enterprise as understood by Krathwohl. This third edition thus reflects and supports Krathwohl's earlier statement of the nature of social research: *Social and Behavioral Science Research: A New Framework for Conceptualizing, Implementing and Evaluating Research Studies* (1985).

The 302-page third edition consists of 17 chapters in five primary sections. The chapters are related to each of the ten steps of proposal development identified at the beginning of the book. Throughout the discussion two viewpoints are shared with the reader, that of the proposer and of the reviewer. This dual-perspective permits the reader to consider each view while working through each step involved in developing a *competitive* proposal.

Section I introduces the reader to the nature of proposals, general concerns, and the steps of proposal development, the content is organized as a series of questions and answers.

Section II, Preparing and Submitting the Proposal, discusses the technical procedures for developing each aspect of the proposal, including supporting rationales. The interdependency among problem definition, related activities, procedures, and resources is highlighted. The four chapters that comprise this section address such issues as developing problem statements, reviewing the literature, selecting methodology reflective of the problem, and producing budget and work plans.

Section III presents six chapters that polish the understanding conveyed in the previous section by tailoring it to 11 different kinds of studies commonly encountered by researchers. The assumption is that information must be relevant to a specific audience if it is to effectively communicate. Also, the earlier material is gathered into 13 guidelines for critiquing proposals and later expanded into a more comprehensive checklist for complex proposals such as RFPs. To help avoid common pitfalls, Chapter 10 summarizes the current research on why proposals fail to be funded. Chapter 11 contains a most important and ambitious discussion of the criteria for judging studies, trade-offs, how various types of researchers emphasize different criteria, reasoning, and ultimately how research findings become knowledge. The criteria for good studies, subsequent judgments, critiquing guidelines, complex proposal checklists, pitfalls, trade-offs, and tailoring suggestions in this section serve to fine-tune a competitive proposal.

Section IV provides useful advice and practical suggestions on how to find federal and foundation funding, including identifying possible sources of support, understanding agency procedures, and responding to their interests.

Lastly, Section V deals with beginning researchers, especially doctoral students preparing dissertation proposals. It discusses the dissertation process from the perspectives of both students and faculty, stressing the implications of these different views. It addresses such issues as how to select committee members, dealing with criticism, emotional experiences, resolving conflicts, and preparing for the dissertation defense.

The book provides 24 extremely useful examples, such as a human subjects declaration, proposal application, peer review score sheet, and sample budget. Good subject matter indexing permits easy access to specific areas of interest. The appendices provide a wealth of information including a 32-item annotated bibliography on sample proposals, funding, writing, and dissertation research; a 20-item source on federal funding; a 168-item source on foundation funding; 86 references; and a 44-item glossary. A powerhouse of information is packed into these last 27 pages.

This third edition is an invaluable asset for the newly venturing student, as well as for the more seasoned researcher. It is a unique example of a thorough technical guide produced within the framework of a strong conceptualization of the nature of research. Its universally positive reception suggests it will make an increasingly significant contribution to the preparation and practice of researchers.

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Research in Hypertext: Focus on Structure in Literacy

Lydia Hajnosz Doty *

What is Hypertext?

Hypertext/hypermedia or "nonsequential writing" provides for a new way of reading/writing that mirrors the associative ways that people think. This new medium has produced much excitement in the education community as it is seen as having potential applications in education, training and in information transfer. However, introduction of this new medium is highly problematic because of its redefintion of the notion of text.

Hypertext is an idea that radically opposes Western concepts of philosophical thought (the Platonic concepts of systematic linear thinking) that are embodied in the printed book. (Heim 1987). In contrast, hypertext, a reflection of the current Cognitive paradigm of thinking, is seen as having the power to "mimic the brain's ability to store and retrieve information by referential links for quick and intuitive access" (Fidero 1988).

Several issues are of importance in hypertext literacy: the ability to locate information in texts, the ability to literally comprehend (recall) what is read vs the ability to make meaning (synthesis & application) of the information read, and the reciprocal relationship between reading/writing hypertext documents. The concept of structure (both the local structure of individual texts and sections of them and global structures of networks of texts) is an essential idea for understanding these issues.

Although there is no clear consensus about how hypertext should be defined, what its essential attributes are, and what design standards (especially in terms of structure) should be followed, one idea seems agreed on: in hypertext, "nodes" or discrete units of information/ideas are connected by "links." Theoretically this means that readers are no longer constrained by the traditional, linear structure of text since hypertext permits them to read freely, to "browse," or to follow "paths" through the structures of nodes/links as they wish. The size of nodes, what should be linked and how these links should be made are unresolved problems.

In the debate over the definition/attributes of hypertext, two sets of issues relevant to instructional text remain highly controversial. One set of issues centers on "constrained hypertext" or structured hypertext vs unstructured hypertext with capability for unlimited free browsing. Some argue that it is essential for hypertext to be organized in some fashion. To eliminate becoming lost in tangled webs of nodes and links (the "lost in hyperspace" problem), readers need guidance in identifying and traversing carefully constructed sequences of links (paths) whose "order of presentation are made by the author in advance" (Zellweger 1989). However, others vigorously resist this notion as it seems a throw-back to the constraints of traditional text structuring and cognitive models that these proponents of hypertext seek to overthrow. The other conflict centers on the question—can a hypertext be considered "true hypertext" if it is a "static" read-only database instead of a "dynamic" database that permits reader(s) to make links and to annotate texts, etc? Proponents of the static view point out that over time, a database's comprehensibility (or fidelity to a knowledge base) would erode if unlimited numbers of links/additions/changes could be made. On the other hand, advocates of annotatable databases say that to achieve its potential for collaborative knowledge construction or generative learning, hypertext documents must provide for read-write capabilities. Both of these issues, critical to the design of instruction, are centered on learner/user control and the unpredictable outcomes that can occur when a high degree of freedom is afforded readers. If hypertext becomes a viable instructional medium, these unresolved issues could challenge existing Instructional Design models which presently focus on objectives and predictable instructional outcomes.

Why Hypertext in Education?

Although electronic hypertext is frequently discussed in the education literature, it is difficult for non-specialists to form clear-cut ideas about the applicability of the medium since few of them have first hand-experience of it. Although the concept of a large network of linked documents (hypertexts) that could be searched and read nonsequentially or "browsed" is an old idea—the paper library card catalogue, HG Well's "World Brain" concept, (Harmon 1988) and Bush's discussion of the "Memodex" (1945) are classic examples of the concept—hypertext, most efficiently realized in electronic form, is a concept that has come of age with the rise of the computer. In the 1960's, Englebart's *Online* System (now *Augment*) and Nelson's (originator of the term "hypertext") *Xanadu* demonstrated how large hypertext systems could be efficiently operationalized in powerful computer environments. (Nielsen 1990, Saffo 1987). Since hypertext has been primarily viewed as a research construct, most hypertexts have been demonstration systems. However, there are a few examples of large-scale experimental hypertext systems being used

in instruction. Brown University's *Intermedia* project, a widely cited mainframe experiment, (Yankelovich et.al.1987), Harvard's *Perseus*, a *HyperCard* Classics project, (Crane and Mylonas 1988), and Southern California's *Project Jefferson's "Electronic Notebook,"* a HyperCard shell for interdisciplinary research and writing are among the best known examples of hypertext systems being used to teach courses. However, these experimental instructional systems do not have commercial counterparts nor have comprehensive judgements of their pedagogical effectiveness yet been made.

The "foreignness" of the hypertext concept is compounded because few readers outside of the academic/research community are familiar with good examples. Many of the readily available hypertext documents (often commercially produced *HyperCard* stacks or shareware) are crudely written or are merely linear, online files that don't take advantage of the medium's capability, using its links merely as page turners or fancy footnotes. Even hypertext work with serious literary and scholarly merits such as Michael Joyce's interactive, electronic fiction, "Afternoon" (written as a prototype document for the hypertext system, Storyspace and often cited as a model for the aesthetics of creative electronic writing) (Moulthrop 1989), and the Association of Computer Machinery's database of hypertexts about hypertext (currently being produced as an experiment in collecting and converting existing paper documents to hypertext) can be disorienting for readers skilled in conventional reading strategies. Ordinary readers often think of hypertext documents as esoteric experiments detached from the ordinary rhetorical purposes and conventions that they have come to identify and expect in texts.

Recently, this rarefied view of hypertext has been revised, as hypertext/hypermedia has become a widely cited topic in the general education literature and in the popular press. Authoring systems that do not require extensive computing/programming expertise have been introduced. In 1987, the introduction of Apple's *HyperCard* (a system that trades relatively limited hypertext capabilities for ease of use) has made hypertext authoring feasible for educators. Since hypertext documents have, in essence, come out of the laboratory and are now a "real" possibility, instructional designers/teachers must make decisions about their use in ordinary instructional contexts.

In the literature of Education, Training, and Information Science claims have been made for the utility of hypertext software for pedagogy, research, and information transfer. For example, hypertext has been proposed as an ideal medium for tutorials, electronic textbooks, reference materials and technical manuals that can be used by learners according to their individual differences, needs and preferences. Since large hypertext knowledge bases can be efficiently searched, linked and added to by multiple users with many perspectives, hypertext systems have the potential to be used as online teaching environments. (ie. like Intermedia or Perseus). In addition, hypertext can be used to build unique tools with instructional applications. According to Horn (1989), hypertext is an ideal medium for storing and presenting information as a modularized and organized structure of "maps" that can be utilized by a variety of target populations for a variety of objectives (both initial learning and later reference). Educational claims for hypertext might be roughly divided into two aspects of how hypertext functions as a tool.

The first of these views, a more traditional perspective, sees hypertext as an important information management tool that allows students to interact with information to construct knowledge. Tchudi (1988) posits that Hypertext databases can be used to develop critical thinking skills in students who use them in inquiry learning activities. Students who engage in these kinds of inquiry activities learn by exploring topics through interdisciplinary materials and by making their own contributions to the knowledge base that they study. Echoing Tchudi, Multiple Intelligence theorist, and developmental psychologist, Howard Gardner (1989) suggests in his "Individual Schooling Plan" that Hypertext is a medium (by nature of its attributes and underlying symbol system) that may help to foster creativity; it can be used to support the kinds of discovery learning (free inquiry) that is essential in certain cognitive developmental phases and in the nurturing of specific intelligences. Hypertext's ability to facilitate flexible, intuitive information searches of large databases and its linking and annotating attributes make it well suited to this kind of instructional activity.

In the other related perspective, hypertext benefits are associated with its ability to insinuate itself in the thinking process, to become a kind of cognitive tool. Hypertext's webs of nodes/links mirror Cognitive psychology's conceptual models of information processing and storage. For Dede (1987) hypertext's value lies in that it is a "cognitive enhancer" that allows writers to externalize in the hypertext system the knowledge schemata that are stored in their long term memories. In a related line of thinking, Jonassen (1988,1988a), while tempered in his claims by his acknowledgment of the slender research base, theorizes that hypertext will become a tool for generative learning activities that will help students to deeply process information. Using hypertext will allow students to relate and incorporate existing knowledge structures into their own schemata to create personally meaningful, new knowledge. Hypertext may contribute to instruction because it increases the "mindfulness" and mental effort learners need to expend in processing information (Salomon, 1983).

The Research Base

Since hypertext research and development is a multidisciplinary (but not always cooperative) effort, relevant data, reported in numerous discipline-specific forums, is difficult to collect. A selected review of Education-Training, Information Science, and Composition-Rhetoric literatures yields some case studies of the major research systems, anecdotal evidence of individual teachers' experiences with hypertext, many descriptions of pilot projects and prototype systems, theoretical discussions, and design guidelines. However, there are few reports of formal research that measures learner-user gains from using hypertexts. Since reading is the primary way of interacting with or learning from hypertext, many of the extant studies seemed to focus on measures such as recall, reading comprehension, time on task, accuracy of retrieval of information, etc. At this point in the research, what has been reported is inconclusive, merely suggestive of possible gains.

Since there is little specific research directed toward the effects of hypertext reading/writing on student performance, relevant online reading and composition research was reviewed. The hypertext studies that were looked at seemed to support the findings of previous research in traditional online writing/reading (Haas 1987, 1989; Haas & Hayes 1985,1986; Hansen & Haas 1988) which shows that users preferred paper and were faster and more efficient when using the traditional medium. Student writers working online often have difficulties with a "sense of text"; they have problems reading onscreen text or with reading electronic documents critically. Many writers print hard copies of their work in order to revise effectively (i.e. to rethink ideas or to rework structure). In a related finding, Kowalski (1990) found that college students, who were competent peer editors of paper texts, were unable to effectively critique the work of other writers when they read it online. Except for workstations, with larger screen sizes where "results are closer to paper" (Hansen & Haas 1988), paper reading/writing environments have proved superior. The state of current technology — small screens, poor CRT resolution and related human factors — were partly held responsible for paper's superiority. These types of findings seem to parallel many students' experiences with hypertexts. For example, in an anecdotal report, David Jonassen (Nov. 1990) told a Syracuse University colloquium audience how professors of students using the Intermedia system complained that their students did not study hypertext course material online. Rather, students printed paper copies of their hypertexts for study offline and presumably reread the documents in linear fashion.

Preference for linear structure and traditional media was a major theme in other hypertext studies. Even when students did just as well in performing tasks with nonlinear electronic text, they preferred linear text (in paper or electronic forms). Talbert & Umphress (1989) showed mixed results when students who studied from a hypertext tutorial developed by the researchers were tested on recall. When students were tested via concept-mapping, they were able to reproduce many of the themes they read about in the hypertext. However, when the same group was tested via objective tests on the same material, they did poorly. In addition, Talbert & Umphress' student subjects reported dissatisfaction with learning the material in hypertext because it was "not the usual method of reading." Similarly, Wang & Liebscher (1988) reported that library graduate students were able to find information faster, experienced more satisfaction, and achieved better results when they used ordinary paper indexes and databases than when they used hypertext databases or browsed on keywords in the hypertexts.

Hypertext use seemed more successful when users had some experience of the knowledge base and hypertext software, when they were not required to read full texts, and when they dealt with well-structured, technical information. Egan et. al. (1989) found that subjects with statistical background could locate statistical information faster in running text using hypertext. Conversely, information in headings was located faster using paper texts. The researchers concluded that hypertext was useful to locate information in other ways than by the way it was originally structured by its author. In another study, students who were questioned about information in a 1000 word general subject article in hypertext and in a linear, paper text had better recall of information from the paper version (Gordon et. al. 1988). However, when the subject matter was switched to technical content, readers' recall of information in both types of texts was about equal. The research team attributed the differences in outcomes to possible student inexperience with hypertext and to the fact that hypertext does not seem suitable when reading a text in its entirety is required. Monk et al. (1988) found that recall of information in a small hypertext was improved when structural maps of the content were provided.

Discussion of Current Research

Some general themes are evident in this sample of studies:

- reader preference for the traditional medium—paper;
- reader preference for linear text over nonsequential text;

- better success when locating well-structured kinds of information (e.g. factual information);
- better information retrieval/recall when extensive reading online (with its heavy storage demands on users' short term and long term memory) was not required.

An analysis of these themes has implications for future research.

1) Users are experiencing the kinds of problems with reading hypertext that have often been predicted and extensively discussed in the design literature—the problems of disorientation and cognitive overload. The state of knowledge about these problems and their causes still needs considerable refinement.

2) There are other important implications for hypertext in that readers are not abandoning their preferences for linear or paper texts. These preferred options may be just ingrained habits. While conceding that processing electronic text might be different from processing paper-based text and that this possibility needs further exploration, Hartley (1987) suggests that difficulties with online reading might be a result of the fact that it is a "newish activity" which people need time to adjust to. Pointing out that effective use of hypertext calls for a new kind of training in literacy – new strategies of reading/writing, Marchionni (1988) calls for a systematic training of teachers to "teach the new tools of learning." Wang & Liebscher (1988) also note that although designers of hypertexts claim that little training is needed to use the software, their research subjects' performances were positively affected by practice on the *Hyperties* system used in their study. Assessment of hypertext's effectiveness can only be confounded if subjects are not first trained in the appropriate methods and strategies of the medium's use.

3) The preferences for paper also are indications that the orienting structures afforded by traditional, paper text structures (or even linear online texts) are missing in hypertexts and thus user performance and comprehension are impaired. Hypertext's presentation of information in discrete nodes oftentimes eliminates local discourse cues that readers use to comprehend texts. For example, traditional structural techniques like using signal words that offer sequential or relational information (such as "first," "however" "in addition") or using pronoun reference to make a text coherent may not work in hypertext because the reader bypassed nodes that contained this information. Charney (1987) theorizes that without these global or local clues, readers make poor choices about how to structure their reading (selection of links to follow).

In his psycholinguistic studies of cognitive strategies in hypertext processing, Rouet (1990) points out that in traditional texts topics are sequentially organized with physical proximity reflecting semantic relationships; however, not all semantically related topics are located near each other in the text. In hypertext reading, readers can pursue their own reading objectives (not necessarily the ones intended by the author). They can read topics as they choose unrestrained by the physical, sequential structure of the text. The "trade off," however, is that many readers experience disorientation when they are no longer able to rely on the relational clues provided by authors or the physical clues formerly provided by the traditional text. In studies of adolescent hypertext readers working with relatively small databases, Rouet found that nonlinear text processing requires two cognitive strategies—"global orientation," purposefully selecting text until objectives are met and "local orientation," understanding thematic organization of nodes of information and selecting consistent links based on that understanding. Younger readers and readers with weaker, traditional reading skills (who were more dependent on the missing clues) did poorly. They were ineffective in monitoring the two orientations and experienced disorientation and cognitive overload.

In another related (ongoing) study of the reader disorientation problem, Castelli et al. (1990) have identified cognitive factors which they theorize are related to effective hypertext use. They are in the process of developing a hypermedia problem-solving test that predicts how successful a user of hypertext will be based on that user's cognitive style.

4) The fact that users with background in a subject domain or who only search for discreet units of information are the more successful users of hypertexts might imply that not all types of texts are suitable to be rendered in hypertext versions.

Structure as a Major Focus for Research

In the last part of the paper I would like to look more closely at structure as a major factor in comprehending text. From its inception, hypertext was thought of as a liberation from the confines of structure. However, that liberation also has brought user frustration, disorientation, incoherence and cognitive overload. Nonlinear text as it is conceived of in unstructured hypertext theory may even be antithetical to the concept of text since many theorists see structure as meaning. Also, "formless" hypertext unbounded by the communication practices and conventions of a "discourse community" seems to have limited practical applications once its author directs it to outside readers. Thus, as hypertext becomes a mature technology, authors are looking for ways of structuring hypertext while preserving its unique characteristics. Psycholinguistics, Semiotics,

and Rhetoric are some of the disciplines to which they are turning for guidance.

Psycholinguistic Text Processing Models' Influence on Hierarchical Hypertext Structures

Cognitive psychology and psycholinguistics have been important influences for structuring hypertext. Several text processing models are seen as a basis for developing the idea of hierarchical structuring of hypertext documents and have exerted considerable influence on development of evolving conventions such as chunking, node size, types of structural clues. Meyer (1975); Meyer, Brandt & Bluth (1980) identified eight *recurring relationships* that are used to organize paragraphs and provide clues to meaning. (Interestingly enough these relationships are similar to patterns described in Classical Rhetoric such as cause/effect, comparison etc.) Readers recall these relationships better if they were arranged in a tree structure or *hierarchical order*. "Signaling" or *providing clues* to causal or logical connections of these relationships also facilitates recall of information. Another significant influence is the Kintsch & Van Dijk (1978) model which postulates that macro-operators reduce information to gists (summaries) which are under the control of *schemata* (theoretical formulations of the reader's goals, many of which presumably are informed by conventions formed via social, educational and cultural influences). Readers mentally structure text as sets of *propositions* that they relate to new propositions by means of *"bridging inferences."* Only a limited number of working propositions can be held in *working memory*, and the longer a proposition is active, the more likely it will be encoded in long term memory.

Based on this research, the "conventional wisdom" in hypertext design literature privileges hierarchical structure (and the linking strategies it implies) as the optimal method for structuring hypertexts. J. Smith et. al. (1987) (J. Smith 1989) predicts that looser hypertext organizational patterns (ie. environments that focus on the "experience of the reader," directed graphic structures) are fine for games, research systems or literary forms. However, he cautions that "no forceful, action-oriented communication" can result from hypertexts that lack hierarchies and overviews. To demonstrate this end, he and his associates have built a prototype system--*WE* (Writing Environment)—that guides writers through the process of construction of documents to "transform loose associative networks of ideas into a hierarchical structure that can be transformed into an electronic or paper document." In texts meant for online information retrieval, hierarchy is also privileged. Girill (1985) suggests that online text that is searched should be organized hierarchically and not by narrative (progressive disclosure) or autonomous (fully contained) structures. Girill sees the hierarchical structure as one that conserves system memory and facilitates rapid, efficient information retrieval.

Of the many hypertext systems based on these text-processing models, Horn's (1989) *Information Mapping* is a particularly interesting example of how a hierarchical hypertext structuring system that is highly constrained can be implemented for certain types of texts. In *Information mapping*, information is decomposed into chunks of "relevant" information (considering short term memory constraints). These chunks are expressed in a consistent format—as labeled information "blocks" (classified according to Horn's scheme of types of information). Blocks, in turn, are arranged in hierarchically ordered "information maps" which contain graphic and textual "signals" and headings and subheadings which substitute for traditional discourse clues. Ultimately, content is structured by "hypertrails" or sets of related maps; the hypertrails and overview maps allow readers to see finely-grained perspectives of all levels of the document's hierarchical structure and thus make reading choices. While Horn claims that this system is a totally new system of writing, many of the system's features seem based on principles/intentions of Classical Rhetoric, albeit more systematically and clearly implemented.

Constrained, hierarchical systems such as *Information Mapping* or *WE* may make hypertext a viable and attractive option for many purposes because they, in effect, give the reader many options to get to a predetermined goal or rhetorical purpose, and they decrease the danger of cognitive overload. However, the implied claims of being a generic structure suitable for all types of texts may not be valid. As Romizowski (1990) observes, an author's decision to utilize the hypertext medium should be based on a thorough analysis of the nature of the communications problems being addressed.

Structure as a Reflection of Purpose/Meaning

While hierarchical organization is a concept whose utility (especially in terms of making text easily understandable and retrievable) has been validated by psycholinguistics as well as by traditional Rhetoric, it is not the only method of ordering meaning. Semiotics and literary theory (and many educational theorists eg. Salomon & Gardner 1986, Muffoletto 1987, D. Smith 1988, Bowers 1988, Cunningham 1984, Hlynka 1989) assert that structure is one of the many elements of a text's (or media's) meaning that cannot or should not be separated from its message(s). Constructivist theories

suggest that each reader "composes" or constructs her own unique meaning of a message based on the interaction of many interrelated elements such as information content, social context, structure and media attributes (Tierney & Pearson, 1983). In context of this view, understanding or "making meaning" is more than just acquiring new information. These theories with their insistence on the inseparability of media, message, information content, social context and meaning are in direct contrast to concepts, most notably those proposed by Richard Clark (1983), which imply that information flows through a neutral delivery system (a medium) unaffected by that medium into the mind of the reader/user. Clark's theory implies that information and meaning are synonymous, and while his theory allows that a badly constructed message or inappropriately chosen delivery media might impede efficient information transfer, he claims that medium itself ultimately does not play a significant role in the information derived from the message it conveys. If one were to view a hypertext through a constructivist paradigm instead of through Clark's information transfer model, structure, as an essential attribute of the medium, becomes an element of hypertext's meaning and not just a vehicle to convey information (Doland 1989, Moulthrop 1989). Therefore, if structure is an element of meaning, an exclusive insistence on one type of structure (such as a hierarchical one) could limit or change the possible meanings of a hypertext. Alternative types of hypertext structures must be explored.

One ordering principle might follow from the rhetorical concept of analyzing purpose or the design dictum—"form follows function." DeYoung (1990), based on her work with her prototype, *Electronic Working Papers*, a hypertext system that models the intellectual processes involved in doing audits, suggests that the structure of hypertext links should reflect the structure of the task being performed. When aesthetic consideration becomes an organizing principle, attention should be focussed on a discussion of narrative structure and not the number of links to be made (often the common structuring idea employed by many writers). Thus, from this perspective Anderson (1990) proposes a "rhetoric of paths" (a conscious choice of patterns of sequences or "syntagmas" that could be invented or borrowed from semiotics/rhetoric). Anderson stresses that the multiple structures (paths) for reading must be preplanned to be coherent, but more importantly, they need to be aesthetically pleasing in order to make reading a meaningful experience. In another concept of ordering according to function, Franklin (1988) suggests that hypertexts with instructional purposes be based on path structures informed by Salomon's (1979) statement that media can initiate thought processes and that attributes of media can help to supplant mental skills that learners may not possess. Therefore, Franklin suggests guided, concurrent paths through the same material that supply information, activate thought processes, and teach mental skills.

Social Implications of Hypertexts

Much of the "hype" surrounding hypertext has dealt with its information management capabilities. However many of the social implications involved in the media have not been carefully considered. Few writers point out that being able to locate or browse information at will is not equivalent to having knowledge, understanding or even aesthetics enjoyment. If the Semiotic viewpoint holds — that texts are reflections of and influences on social relationships — then by changing the way we read and the the way we construct texts, we may influence society. By using hypertexts in their classrooms teachers must realize that they may be affecting the larger views of their students. For example, hypertext changes meaning when it decomposes ideas into units of information and arranges them hierarchically. These online texts are meant to be viewed analytically instead of holistically. Thus fragmented texts take on new meanings "as sources of information rather than models of human experience to be transmitted from one generation to the next" (Baron 1988, 380). Baron also speculates about how conditions of reading (ie."under a tree" or at a CRT) change cognition or if personal relationships change when a computer mediates human communication (ie. collaborative hypertext?). Even the construction (information content/structure) of instructional hypertexts needs close consideration. Doland (1989) observes that hypermedia is not a hermeneutically neutral act, that it "possesses its own meaning and impresses its own meaning on texts." Like traditional writing, hypertexts are "rhetorical tools" whose function is to persuade, influence, and inform readers of an author's views/values. Just as traditional writers construct the meaning of their texts by making deliberate rhetorical choices (such as information content, style, diction, structure), hypertext designers must also make considered choices that shape their electronic messages. Since all texts—paper or electronic — convey meanings and values in addition to their intended information content, all writers and designers must be aware of the effects of their rhetorical choices. This "gatekeeper" function is especially important in developing educational hypertexts since certain political, social, and cultural messages can be amplified or distorted. Also naive readers may mistake a constructed viewpoint (a network of many texts) as a "given," mirror of reality (Doland 1989, Bowers 1988, Muffoletto 1987).

The social implications are an important aspect of hypertext's meaning. However, as D. Smith (1988) notes Classical research methodologies are not helpful to guide educators in this problem and new research methods must be developed. Seeing hypertext from a

Constructionist/Social/Semiotic view as unique, media must change the nature of Hypertext research itself.

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Job-Aids

Interactive Multi-Media for Education, Part 1: Concepts/Applications

Alexander Romiszowski and Andrew Abrahamson *

MAP #1 IMM IN EDUCATION: AN OVERVIEW

Introduction

This is the first of a multi-part series of reference materials on the topic of "interactive multi-media" (or IMM) and their use in education and training. The first three parts will cover:

1. *Concepts and applications of IMM*
2. *Design of instructional applications of IMM*
3. *Developing IMM: tools and techniques.*

*This first part can be seen as dealing with the **what** and **why** of IMM.*

What is IMM?

There are almost as many definitions of IMM as there are writers on the topic. It has become the "buzz word" for the latest computer developments in digital storage and processing of graphics and video for whatever purpose. But in education, there is a long history of the use of this term, or at least its components — media, multimedia, and interactivity.

The first few maps that follow "unpick" the term and clarify (maybe extend) the meaning we should be giving to IMM in the context of education and training applications.

Why IMM?

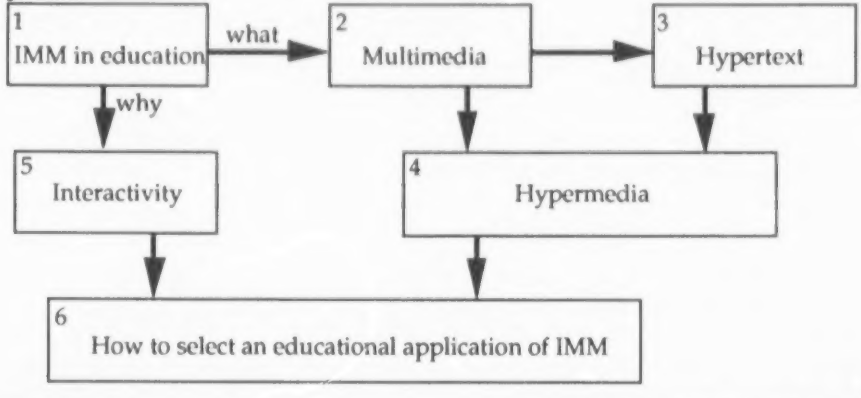
As the technological possibilities of capture, storage, interlinking, transmission, and use of information (in any format) expand, we are inexorably driven to apply the new technologies in just about every field, including education. But what do educators hope to gain from these applications? In what specific ways can the new IMM technologies really make a difference to the quality and cost-effectiveness of educational and training programs? The answers are not all that clear.

Why ask?

An illustrative example of the need for more clarity, in both concept and purpose, is the story of the reasons behind the organization of the International Interactive Multimedia Symposium, in Perth, Western Australia, January 1992.

The main conference organizer/sponsor was the School of Electrical and Computer Engineering of Curtin University, where, for over 5 years, some 20 faculty members have been developing interactive multimedia for use in their own teaching. The conclusion of over 100 work years of communal experiences was that "it had made no difference to learning — what are we doing wrong? — let's organize an international conference to find out." Incidentally, perhaps because of this angle to the theme, it was one of the best IMM conferences ever!

What's coming up next?



MAP #2 MULTIMEDIA

Introduction

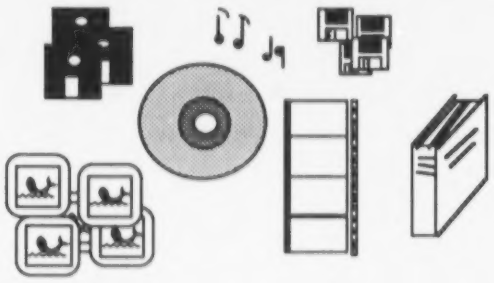
Imagine that you are in a kindergarten class full of excited 5 year olds. One student draws with a crayon. Another student spreads finger paint on a long sheet of paper. A third student uses building blocks. The teacher shows a film strip. Imagine that all these people are trying to show what the White House looks like.

If you look at only one of these presentation forms, you would get only one mental picture. If you view all these presentation forms, you get a much richer mental picture.

Definition

Multimedia is the use of multiple presentation forms to display information. These presentation forms, referred to as media, may include either high or low technologies.

Diagram



Historical Development

The use of multimedia is not a new practice. However, the use of multimedia controlled or enhanced by computer technology is a recent innovation. Today, when we think of multimedia, we often associate the term with high technology presentation forms such as videodisc and CD technologies.

The possibility of storing all forms of information presentation as digital data on one convenient storage device and then rapidly accessing any combination of parts of this data base has revived earlier interest in the use of complex multimedia presentations.

Multimedia Elements

Multimedia can be thought to consist of three elements: media, technology and products. In the past we have focused primarily on the media. In recent years we have paid more attention to the technology involved in computer-aided multimedia. In order to develop the most appropriate media for an instructional episode, instructional designers must also consider the products of multimedia presentations.

Examples of Elements

MEDIA	TECHNOLOGY	PRODUCTS
TEXT Words Numbers AUDIO Music Speech VISUALS Still Images Movies Animation etc.	Optical Storage Computer Video Technology	VideoNotebooks Video Editing Tours Simulations Adventure Games Talking Books Tutorials Teacher Lecture Aids

MAP #3 HYPERTEXT

Introduction

Imagine that you are creating an interactive computer-based presentation on an important historical novel. You have obtained and stored the book electronically on a hard disc. Now you want to include text which describes:

1. *the book, it's storyline, it's style, it's period*
2. *the author*
3. *the importance of this work in relation to the period it is set in*
4. *its relationship with other works by this author and works of other authors*
5. *other works that deal with the same historical period.*

Traditional texts have been linear in nature. They flow from one idea to the next. However, the creator of this presentation would want a text that is not linear, but one that links one idea with another — one that connects one set of information with another.

Definitions

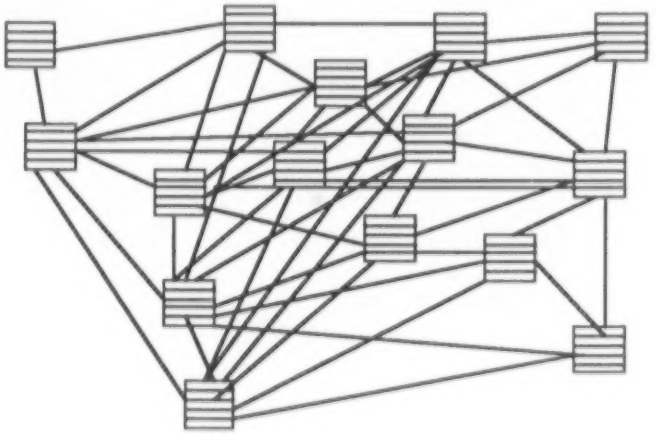
1. A text written and organized as a structure of interlinked information chunks or nodes, that can be read in many different sequences, for different purposes, at different levels of detail or difficulty, depending on the reader's interest, needs, and abilities.
2. Computer software that enables authors to create and store such information structures, and readers to browse through them rapidly and convienently.

Purpose

Hypertext allows words or ideas, to be associated with other words or ideas. Hypertext fosters non-sequential thinking/working/creating that enables users to associate chunks (NODES) of information together through a variety of LINKS or connections. It enables users to access greater depths of information by moving between related documents which share thematic connections. Hypertext aids the user in forming an idea of the STRUCTURE of a body of information.

Diagram

The essential attributes of a hypertext (NODES and LINKS, which form a browsable STRUCTURE of information) are illustrated in this representation of a hypothetical knowledge base.



Examples

1. Hypertext is usually associated with electronically stored screens of information, which can be "browsed" by activating "buttons" built into the text. Clicking on a button brings up another screen or a "window" containing related/more detailed information. The most widely known examples of hypertext are the many browsing databases created by users of Apple Computer's "Hypercard" authoring software.
2. However, hypertext need not be electronically stored. Encyclopedia Britannica is an example of a form of hypertext in that it stores information in small chunks that can be interlinked by the user, at will, through use of the indexing and cross-referencing facilities provided.

History

We often associate hypertext with Apple's Hypercard. However, hypertext predates Apple's product by nearly 30 years. Before the advent of the microcomputer, Theodore Nelson coined the term "hypertext" in 1965. He conceived of a "worldwide network.....of the word's stored writings, graphics and data." Before the term was coined, the concept was already made to work in a computer-based environment, by Douglas Engelbart (1962 onwards), who developed the Augment system at Stanford. The concept is now commonly accredited to Vannevar Bush, who proposed the Memex system of electronically interlinked documents as early as 1945. However, the origins of structuring information as "nodes" which are interrelated by defined "links" are probably centuries old, originating in the habits of researchers to create personal sets of "note cards" to structure a complex subject matter, and then to create reference works, like dictionaries and encyclopaedias, to communicate the subject to others.

Some Variable Dimensions of the Hypertext Concept

Philosophy	vs	Pragmatism
The non-sequential multi-dimensional storage of information is a characteristic of the human mind. Associative linking is a characteristic of creative thinking. So it should be more "natural" and more "useful" to structure external knowledge bases in a similar way.		It is impossible to predict the information needs of a particular individual reader, so it is more effective and more economical to structure a knowledge base so that it can serve the information needs of any reader, under "user-control."
Constructivism	**vs**	**Objectivism**
Knowledge structures are personal unique representations of reality which are formed through interaction with one's environment, colleagues, etc. A hypertext is an external record of the unique structure imposed on a domain of knowledge by an individual or a collaborative group.		A given domain of knowledge may be analyzed, structured, and therefore presented in a manner which will be optimal for both initial learning and later reference. The network of information nodes and the links between them represents the inherent structure of the knowledge domain.
Collaborative Creativity	**vs**	**Systematic Design**
The network of information nodes and the links between them is therefore the result of an act of creativity or insight on the part of the author(s). Any user should be free to annotate or otherwise add to the hypertext.		The preparation of hypertext is a specialist task to be performed by a few skilled designers for the benefit of many readers. Additions or changes to this structure will be the result of the systematic creation of new knowledge.

MAP #4 HYPERMEDIA

Introduction

Imagine a mechanic who wants to learn about adjusting the idle on a modern, computer-controlled automobile. What are the ways that this mechanic could learn? He or she could:

- *read a text report describing various techniques and procedures*
- *watch a motion video of another mechanic successfully adjusting the idle*
- *listen to a description and watch a motion video of the procedure*
- *view slides of various engine parts.*

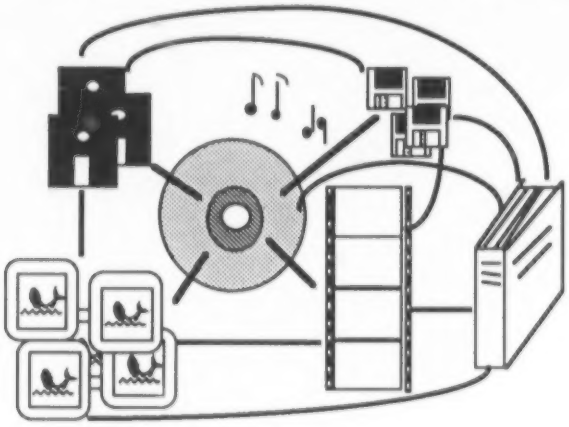
Imagine this mechanic being able to use all of these presentation forms, jumping from one medium to another with the touch of a button.

Definition

Hypermedia is an extension of the hypertext concept, to incorporate a variety of media forms. Hypermedia extends the linking or association capabilities of hypertext to the following presentation formats: graphics, animation, scanned images, voice, sound, music, still video, full-motion video.

Diagram

This picture shows how the concept of Hypermedia is a fusion of hypertext and multimedia.



Hypermedia Delivery Systems

(1) *Interactive Video*

Interactive Video (IV) is the fusion of video and computer technologies. A videoprogram and a computer program run in tandem under the control of the user. In interactive video, the user's actions, choices and decisions affect the way in which the program unfolds. When the video component is stored on a laser disc, the same disc may also store still images, text, audio, etc. (i.e. multimedia). When access is multi-dimensional, non-sequential, and under user control, we have hypermedia.

(2) *Interactive Still Video*

Interactive still video stores images on a reusable 2" floppy diskette. These images can be combined with graphic overlays, menus, and branching routes. Digital cameras will store images directly onto diskettes, thus providing inexpensive, in-house production of a visual knowledge base. Hypertext software (eg. Hypercard) may be used to create the browsable structure element of hypermedia.

(3) *CD Systems*

Digitally stored data and music, on the compact disc format, are now commonplace (CD-ROM, CD-music). More recently, advances in technology have made available systems which store still and moving images on this format. Progress is making such CD-based multimedia/hypermedia systems cheaper and more versatile.

(4) *Workstation-based systems*

As computer power and memory increase, it is becoming increasingly possible to store full-color graphics, photographic quality still images and even motion video on the hard disc, or conven-

tional peripheral storage devices, where they are structured as a hypermedia knowledge base, browsasble under user control.

(5) *Network-based systems*
As computer networks proliferate and data-compression technologies progress, it is becoming increasingly feasible to share information in any presentation format between geographically separated information sources (libraries, archives) and users. The networked "world multimedia library" predicted by Bush and Nelson is becoming a technical possibility.

Hypermedia Development Systems

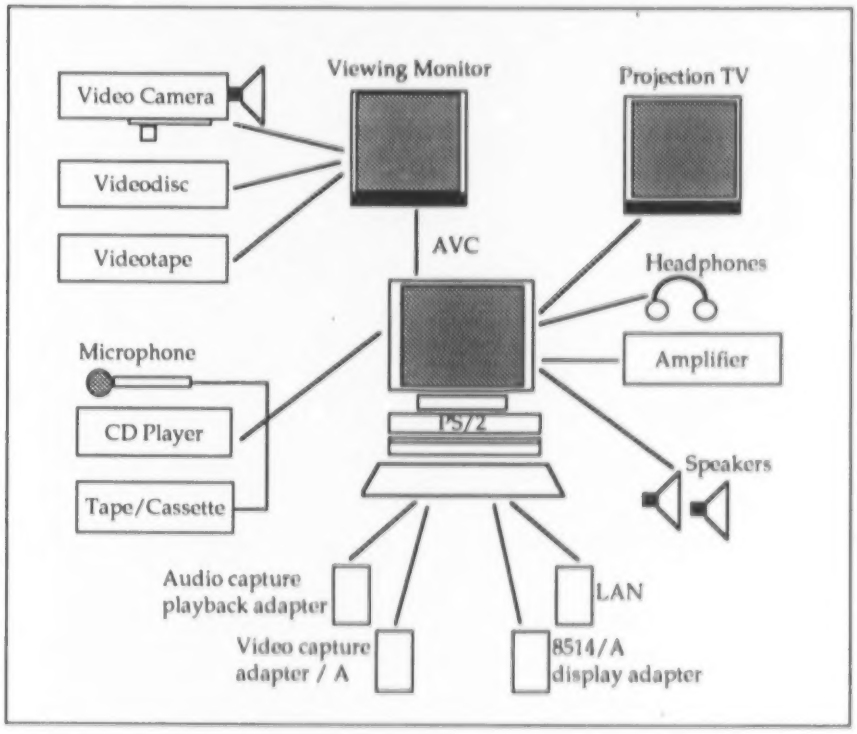
The development of hypermedia (and indeed most linear multimedia) presentations requires a workstation that provides:

- ways of accessing and capturing information in a variety of presentation modes (audio, video, text) from a variety of sources (paper, videotape, online TV, slides);
- image-processing capabilities (similar to the capabilities of text editing offered by a word processor);
- an authoring system capable of originating computer-based text and graphic screens, overlays, etc. (like any CAI authoring system) and also creating the browsable network of nodes and links (a hypertext authoring system).

Example

The IBM *Audio Visual Connection* (AVC) *System* is one of the most sophisticated integrated hypermedia/multimedia workstations available today. The heart of the system, the AVC authoring language, lets the user design hypermedia by manipulating story elements by way of an "object-oriented" language. Objects such as motion video, still video, graphics and text can be manipulated one at a time or simultaneously.

IBM's AVC System

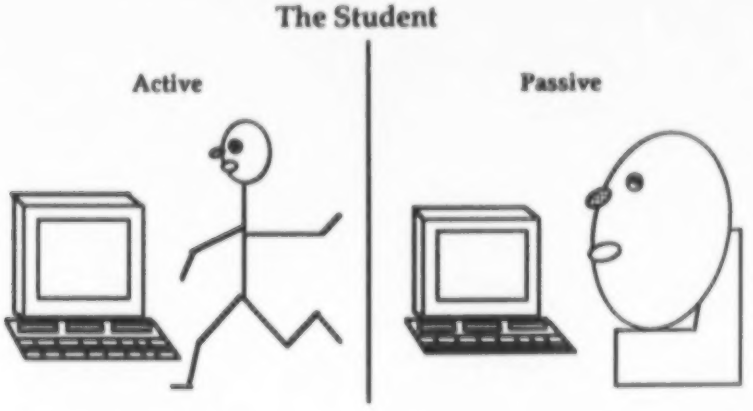


MAP #5 INTERACTION AND INTERACTIVITY

Introduction

In order to understand interactive multimedia/hypermedia and their role in education, it is important to define clearly the various dimensions of interactivity that may be incorporated, singly or in combination, in a given instructional presentation.

The issue to consider is illustrated in the cartoon. How can we be sure that the "active" student on the left is in fact learning more, or better, than the "couch potato" on the right?



Interactive Media

Interactive media involve the viewer as a source of input to determine the content or duration of a message, which permits individualized program presentation. The individualization may involve "system-control" or "learner-control" or a combination of the two.

System-Controlled Interaction

In the past years, technology-based instructional programs have had the reputation of being electronic page-turners. The earliest computer-assisted instruction, based on Skinner's teaching machines, did not provide the learner with adaptive control of the instructional program. Current practice in computer-based instruction has focussed on more interactive, and often elaborate, instructional programs. However, the bulk of such CBI (or CAI) packages control the interaction process by eliciting specific responses to specific questions or tasks, and on the basis of a response-analysis, select the next segment for presentation. Such instructional systems may also be classified as "CONTROL BY FEED-BACK."

Learner-Controlled Interaction

Instructional research and practice during the past 20 years has included more emphasis on learner control. Some studies suggest that at certain levels, learner or user control can be a positive enhancement, allowing branching and individualized routes of instruction. Interactive media, used as instructional tools, can provide the user with the opportunity to have varied amounts of control over the instructional segments presented. The typical procedure is to offer the learner a "menu" of choices of what to do or where to go next. Such systems could be usefully classified as "CONTROL BY FEED-FORWARD."

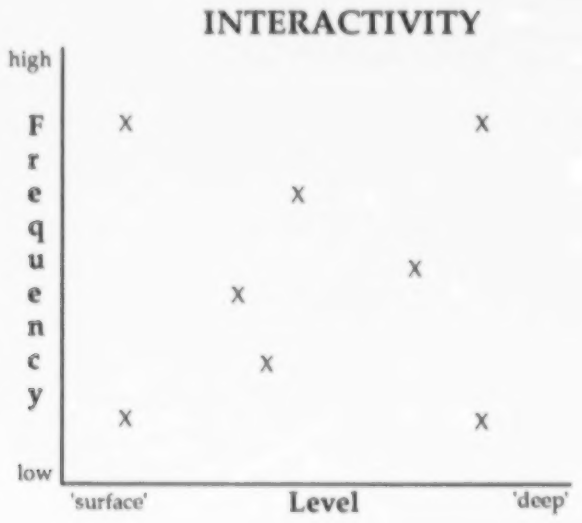
Frequency of Interaction

The most obvious characteristic of interactive instructional/informational systems is that the user is actively engaged in the clicking a mouse, touching a screen, entering information with a keyboard, etc. Many potential users (and indeed designers/developers) view this as the principal (perhaps only) measurable characteristic of interactivity. The frequency of clicking/touching/keying becomes a measure of the degree of interactivity of the system. Some prominent writers (eg. Bork, 1987) have even gone so far as to define the optimal number of seconds between such physical interactions (eg., 15-20 seconds).

Depth of Interaction

A somewhat overlooked (but in instructional contexts much more important) measure of the the degree of interactivity of a system is the extent to which the interactions cause the user to "think." Are the interactions purely "surface" level jumps from one topic to another, without the need to relate the topics clearly to each other in the mind, or are the challenges set up by the system such as to encourage a "deep" level of reflection on the topic?

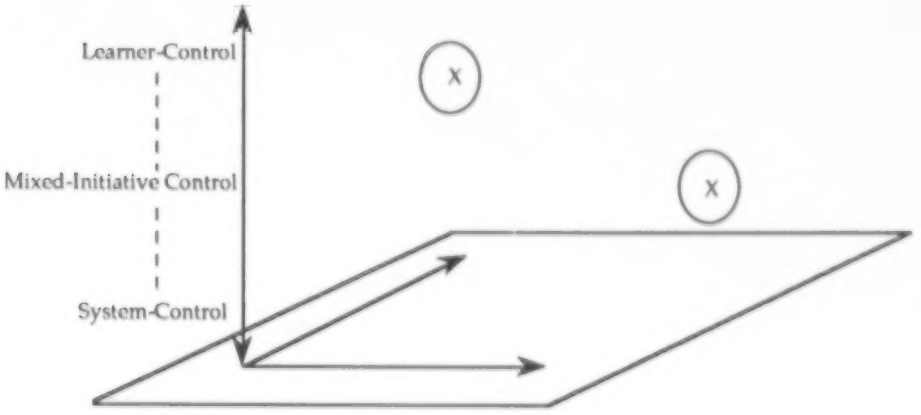
Diagram



This graph attempts to illustrate two dimensions of interactivity. Each point represents a possible interactive multimedia/hypermedia system.

A Third Dimension Control

Imagine that the points on the diagram above are in fact at different heights above the page, representing where the system lies on the dimension of "control."



Reference

Bork, A. (1987). Lessons from computer-based learning. In D. Laurillard (Ed.), *Interactive Media: Working Methods and Practical Applications*, pp. 28-43. Chichester, U.K.: Ellis Horwood.

MAP # 6 SELECTION AND DESIGN OF IMM APPLICATIONS

Introduction	*There are two convenient general ways to classify educational/training applications of IMM (or indeed of most other categories of educational materials): by category of CONTENT; or by category of INTENT. Classifying by objectives, or INTENT, is useful in that it focuses on the intended outcomes as a way of identifying appropriate teaching methods and media. Classifying by CONTENT is useful in that it focuses on the media that may be appropriate for storage, transfer, and access and also on the structure of the knowledge base.*
INTENT – to inform	1) Informational IMM. There is a body of knowledge to be disseminated and this knowledge exists (or can exist) in a variety of media formats. Bringing this knowledge together in a common, digital format as an organized and structured knowledge base will make it more accessible and more useful, both as a basis for learning and as a general purpose reference resource (a multimedia library). The system provides FEED-FORWARD interaction (guidance/advice) to allow user control over content/sequence.
– to teach	2) Teaching IMM. Although an information system may be used in teaching, it must be enhanced to become a full teaching system. There are two sub-categories: 2.1 Instructional IMM Systems. Instruction implies that specific learning objectives are to be achieved. This in turn implies evaluation of learning and FEED-BACK, usually of a corrective nature. This sub-category may offer little learner control over the process of use and interaction (i.e. multi-media CAI) or learner control over content and system control over intent (i.e. instructional hypermedia). 2.2 Conversational IMM Systems. Conversation here implies that both "learner" and "teacher" may initiate interaction, that the objectives and content of a session are negotiable, but there is still a "teacher's" responsibility to help the student to learn. Such systems have to be rich in both FEED-FORWARD and FEED-BACK interactivity. Moreover, the interactions must be "deep" rather than "surface." "Structural Communication" (see Instructional Developments, 1(2)) is a methodology for implementing conversational systems in a multi-media environment, which stops short of the complexity of intelligent tutoring systems.
– to motivate	3) Motivational IMM. Although much is said about "engaging" the learner, instructional theories (and conversational theories) do not, in general, address the issue of generating initial interest and motivation for learning (a notable exception is John Keller's ARCS model). Professionally designed mediated presentations (e.g. Hollywood movies) are often highly effective in this respect. The role of IMM in gaining ATTENTION and establishing RELEVANCE (the A and R of ARCS) may be its most important role in education.
– to entertain	4) Entertaining IMM. Using IMM to entertain may be part of a teaching strategy for a dull activity (e.g. drill-and-practice). If may also be indicated as an opening pre-instructional event, in order to relax the learner and create a receptive climate for learning. However, beware of "educational" IMM that are exclusively entertaining, without any intent to inform, teach or motivate.
CONTENT – factual vs conceptual	Factual content (specific factual information, routine procedures, etc) is often unnecessary to learn (memorize) if it can be made available as "user friendly", convenient and effective reference material. IMM may often be an ideal approach to the creation of on-the-job "performance support systems." Conceptual content (concepts, principles, theories, strategies) has to be "understood" so it can be applied across a range of case examples. IMM may assist both in the presentation of the content in a more understandable way and in the provision of a variety of realistic cases/examples.
– loosely vs highly structured	Loosely structured content (discrete, independent items) lends itself to presentation in an "encyclopedia" format, with each "mini-presentation" catalogued and indexed to be accessible under user-control by means of glossaries, key words, and other search tools. Highly structured content (complex knowledge domains) requires the component items to be interrelated, so that a user may learn the "big picture" as well as the details. A "hypermedia" format is appropriate, designed on the basis of a thorough content analysis and providing both "feed-forward" and "feed-back" links and frequent advance organizers and summaries.

Summary of Design Issues

INTENT IS TO:	1) IMM Potential	2) Design bases	3) Key design issues
ENTERTAIN	Slick presentations	Film design Graphic design	Linear, system controlled presentations are better
	User involvement	Game design Simulation design	Should be interactive, under user control
MOTIVATE	Gain attention through impact	ARCS model Motivation theories	Seek "emotional engagement" in the task
	Show relevance to real life	Needs analysis Audience analysis	Many examples or contexts for a varied audience
INFORM	Structured knowledge base	Information science Content analysis	Use Information Mapping and other organizing tools
	Networking of information sources	Computer science Library science	Compatibility and access problems must be solved
TEACH	Multimedia "instruction"	Objectivism Instructional theory	Provision of practice and feedback is essential
	Networked "conversation"	Constructivism Conversation theory	Structural Communication or "ICAI" as design models
CONTENT IS:			
FACTUAL	Quick reference knowledge bases Online performance support systems	Job-performance-aids design Expert systems design	Some "intelligence" in the FEED-FORWARD function is desirable (a "librarian" interface)
CONCEPTUAL	Visualization of abstract concepts Application to real examples	Message design Content analysis Audience analysis Situated cognition	Some "intelligence" in the FEED-BACK function is desirable (a "tutor" interface)
LOOSELY STRUCTURED	Multimedia encyclopedias Generic media banks/ archives	Library sciences Audience analysis Content analysis Interface design	Possible use of multiple authors/sources for the separate components of the system
HIGHLY STRUCTURED	Hypermedia networks Specific user applications	Schema theory Subject expertise Content analysis Information mapping	There must be a central team responsible for designing the structure and the components

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